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ELECTRONICS AND ELECTRICAL ENGINEERING

No. 72

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AMPLIFIERS

UDC 621.375.4

STRICTURAL SYNTHESIS OF AMPLIFIERS BASED ON DIODES WITH INTERVALLEY ELECTRON TRANSFER

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 25, No 5, May 80 pp 1024-1029 manuscript received 14 Dec 78

LOGINOV, M. M., MOGILEVSKAYA, L. Ye. and KHOTUNTSEV, Yu. L.

[Abstract] Impedance measurements are made of three types of diodes with intervalley electron transfer (MEP-diodes) in the 6 GHz band. The parasitic parameters of the diode housing are determined. The structural synthesis of a broad-band amplifier is conducted on a computer for two types of the diodes investigated, based on the results of measurement of the input resistance of a MEP-diode in a small signal regime and a subsequent approximation of the input resistance of the diode by the impedance of a series R-LC network. The investigations conducted show that: 1) The impedance measurements of MEP diodes make it possible to obtain important information necessary for investigations of diodes and designing of radio engineering devices based on these devices; 2) The use of a computer in the process of structural synthesis makes it possible to calculate the circuits of amplifiers with a wide transmission band, taking account of all the frequency dependences of the impedance of MEP diodes; and 3) The possibility is shown of employing a computer in the process of adjustment of a circuit in order to obtain optimum results. Figures 5; references 7: 6 Russian, 1 Western. [284-6415]

UDC 621.391.8

DISTORTION OF FREQUENCY-MODULATED SIGNAL IN A MICROWAVE TWO-CIRCUIT SYNCHRONOUS AMPLIFIER

Kiev IZV. VUZ: RADIOELEKTRONIKA in Russian Vol 23, No 5, May 1980 pp 46-50 manuscript received 6 Apr 79

GUBAREV, V. F. and FOMIN, N. N.

[Abstract] Recently interest has increased in the use of synchronized oscillators based on various types of semiconductor devices for amplification of signals with angle modulation in the microwave band. The few works devoted to the distortion of a frequency modulated signal in such "synchronous amplifiers," consider only one-circuit oscillators, because microwave band oscillators generally have more complicated oscillatory systems. It is known that the efficiency of synchronization of two and more circuit oscillators may be considerably greater than the one circuit, and consequently with identical parameters of the signal in two-circuit synchronous amplifiers it is possible to expect a lower level of distortions. The present paper shows and discusses the equivalent circuits of a two-circuit synchronous amplifier: the original circuit and a transformation of it. The first equivalent circuit is that of a two-circuit diode oscillator, synchronized through an ideal circulator. The diode is represented by a nonlinear vector admittance $Y_D = g_D + jb_D$, and the linear part by two microwave oscillators of an arbitrary type, represented in the form of parallel resonance circuits P_1, P_2, with characteristic admittances G, tuned to the frequency ω_c and connected by a quarter-wave length of line with the surge admittance $G_0 = G_N$, where G_N is the load admittance (input conductance of circulator). In such a two-circuit system a critical connection between P_1 and P_2 exists, in the presence of which the phase-frequency characteristics of the system are flattest and the effectiveness of synchronization as a result is maximum. The second transformed circuit shown is in a form where a quadripole between the cross sections b-b, c-c is described by a Y-matrix and the existence of a synchronizing (being amplified) signal with a power P_{vkh} is represented by an equivalent current generator with an internal conductivity G_0. With the use of these equivalent circuits, an investigation is made of the linear and nonlinear distortions of an ordinary frequency-modulated signal in a microwave two-circuit amplifier on a basis of a synchronized self-excited oscillator. Figures 5; references 7: 2 Russian, 5 Western.
[277-6415]

ANTENNAS

UDC 621.396.67.01

ON THE PROBLEM OF SYNTHESIS OF HIGHLY-DIRECTIONAL ANTENNAS WITH DEEP TROUGHS IN THE RADIATION PATTERN

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 25, No 5, May 80 pp 940-947 manuscript received 7 Jul 78

KORNIYENKO, L. G. and FEDINCHIK, S. I.

[Abstract] In practice the necessity often arises for forming deep troughs in specific angular sectors of the radiation pattern of an antenna. Works in the literature show the possibility of obtaining a trough in the radiation pattern by forming nulls in closely positioned directions. In the present work, the problem of forming deep troughs is considered in more detail. The effect is studied of random fluctuations of the field in the aperture of an antenna at the depth of the troughs being formed, their periodic properties are noted, and the possibilities of creating troughs in the radiation pattern of sectionalized arrays are analyzed. Solution of the problem is produced on the basis of a functional selected in a specified way. The authors thank Ya. S. Shifrin for a number of critical remarks which contributed to improvement of the work. Figures 3; references 8: 4 Russian, 4 Western (one in translation).
[284-6415]

UDC 621.396.67.01

INTERPOLATION OF THE REFLECTION COEFFICIENT OF INFINITE PHASED ANTENNA ARRAYS

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 23, No 5, May 80 pp 1090-1092 manuscript received 18 Sep 78

FEDOTOVA, S. I. and SHCHERBAKOV, V. I.

[Abstract] During theoretical and experimental investigations of large phased antenna arrays, an urgent problem is interpolation of the reflection coefficient Γ in the field of scanning on the basis of the set of discrete values $\{\Gamma_k\}$, measured with the aid of a multielement waveguide simulator or calculated numerically. Restoration of the reflection coefficient in the area of the angles of single-beam scanning up to the direction of appearance of the diffraction lobe is of the greatest interest. During this the principal difficulties appear in those cases when, as a function of the module of the reflection coefficient $|\Gamma|$, there are narrow resonance "bumps" corresponding to the effect of "blinding" the phased antenna arrays. Interpolation schemes using a Fourier series and functions of a special form, with the existence of such characteristics, do not permit attainment of a satisfactory precision of restoration of Γ with a small number of interpolation angles. The present short communication describes methods for interpolation of Γ, free from the shortcomings mentioned above. The results of calculations show that the proposed methods of interpolation make it possible with high precision to restore the values of the reflection coefficient of infinite phased antenna arrays in all the region of the angles of scanning up to the appearance of the diffraction lobes both in the absence of resonance effects and with the presence of one and even two resonance "bumps." The interpolation procedure described, the possibility of which is demonstrated by an example of linear phased antenna arrays, can extend to plane antenna arrays. In this case interpolations $\Gamma(\Psi_x, \Psi_y)$ is conducted successively with respect to each of the coordinates. Figures 1; references 4: 2 Russian, 2 Western.
[284-6415]

UDC 621.396.677.4

ON THE POTENTIAL ACCURACY OF DETERMINING THE POSITION OF A POINT TARGET

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 24, No 6, Jun 80 pp 1211-1217 manuscript received 19 Mar 79

NAKHMANSON, G. S.

[Abstract] An estimate is made of the accuracy of measuring the coordinates of a target with diversity reception by antenna arrays with dimensions that are much smaller than those of the entire antenna system, so that the curvature of the received signals can be disregarded on the aperture of each of the arrays, but cannot be disregarded with respect to the dimensions of the entire antenna system. A correlation matrix is found for estimates of the target coordinates in the case of space-time processing of the received spherical wave by such an antenna system. An analysis is made of the potential accuracy of estimates of the range and angular coordinates of a source of emission. An examination is made of conditions of eliminating indeterminacy in estimating coordinates by appropriate selection of the width of the signal spectrum. Figures 3; references: 7 Russian.
[292-6610]

UDC 621.396.677.49

THE METHOD OF LINEAR EQUATIONS IN CALCULATION OF THE STATIC MODE OF AN ADAPTIVE ANTENNA ARRAY

Moscow RADIOTEKHNIKA in Russian Vol 35, No 6, Jun 80 pp 3-9 manuscript received 24 Jan 80

PISTOL'KORS, A. A.

[Abstract] Adaptive antenna arrays are those that automatically adjust their parameters with changing reception or transmission conditions to meet set requirements of the system served by the antenna such as suppressing the radio interference produced by signals or noise arriving from directions that are not known beforehand. The author gives a method for calculating major parameters of such an antenna array: weighting factors, polar pattern, depth of interference suppression, inherent noises of the array and signal-to-noise power ratio. It is shown that these parameters can be determined for static working conditions, i.e., for operation of the array in the steady state during adaptation, by solving a system of

linear equations equal in number to the external interferences, where the unknown quantities are the amplitudes of the adapted polar pattern in the directions to each of these interferences. Figures 1; references 3: 2 Russian, 1 Western.
[296-6610]

UDC 621.396.667.49.001.24

NOISE OF SCANNING PHASED ANTENNA ARRAYS, TAKING ACCOUNT OF RANDOM ERRORS

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 25, No 5, May 80 pp 948-956 manuscript received 13 Feb 77

BABENKO, A. I., DIKIY, V. N. and ZAYTSEV, E. F.

[Abstract] Contemporary receiving phased antenna arrays have in their make-up amplifiers, mixers and other devices which are sources of noise of various origins and have an effect on the signal-to-noise ratio at the system output. Inasmuch as the output resistance of the signal sources (interacting radiators) with wide-angle scanning significantly varies as a rule, this leads to a change of the noise temperature of the antenna in the scanning process. Nevertheless, developers of phase antenna arrays often disregard this circumstances and during calculation of the receiving potential of the system only take into consideration the change of the antenna gain during scanning. The present paper analyzes the effect of the principal sources of internal noise of a phased antenna array on its sensitivity, taking into consideration the fact that the noise in adjoining channels of the antenna can prove to be correlated because of the mutual effect of the radiations. It is advisable to consider the effect of the random deflected parameters entering into a phase antenna array device on its noise temperature. An example is presented of the calculation of output noise and the change of the receiving potential of a phased antenna array during scanning. Figures 5; references 7: 6 Russian, 1 Western.
[286-6615]

A COMBINED-POLARIZATION ANTENNA

Moscow RADIO in Russian No 4, 1980 pp 28-30

KHARCHENKO, K., Leningrad

[Abstract] Television broadcasting in the Soviet Union uses transmission in which the electrostatic field leaves the antenna in the horizontal plane for some channels, and in the vertical plane for others. This makes reception inconvenient if the viewer must have several single-channel antennas that are connected as needed. This article describes a multi-channel antenna that uses one active element to pick up waves with either polarization. Because of lack of polarization selectivity, such a system is more subject to interference than antennas designed for receiving waves polarized in a single plane. To get around the complicated construction and band restrictions of elliptically polarized antennas, the proposed system uses polarization that is turned through a certain angle relative to the earth. If there is no preference for signals of either polarization, this angle is 45°. A rhombic antenna is chosen for the best combination of electrical, mechanical and tower-loading properties. Construction and tuning are explained. Figures 2; references: 3 Russian.
[291-6610]

CERTAIN ASPECTS OF COMPUTER HARD AND SOFT WARE: CONTROL, AUTOMATION, TELEMECHANICS, TELEMETERING, MACHINE DESIGNING AND PLANNING

UDC 62-50; 519.3

OPTIMUM TRAJECTORY CONTROL IN AN INERTIAL COORDINATE SYSTEM

Moscow IZVESTIYA AKADEMII NAUK SSSR: TEKHNICHESKAYA KIBERNETIKA in Russian No 3, May/Jun 80 pp 138-143 manuscript received 25 May 79

KRASOVSKIY, A. A., Moscow

[Abstract] The problem of optimum control of the motion of the center of mass of a moving vehicle is considered for the case where the controlling factors are constant (accelerations). The principle of minimum generalized work is used to solve the problem in an inertial coordinate system in the form of optimum deterministic equations. The specific form of the optimization function is found for the terminal problems of reaching a given point at a given time, reaching a given point at a given time in a given direction, reaching an arbitrary straight line passing through a given point. The proposed algorithms are applicable for any initial relative positions (initial conditions) without restrictions. Figures 2; references: 3 Russian.
[287-6610]

UDC 621.391.268

APPLICATION OF ORTHOGONALIZED EXPONENTIAL FUNCTIONS IN APPROXIMATE CORRELATION ANALYSIS

Kiev IZV. VUZ: RADIOELEKTRONIKA in Russian Vol 23, No 5, May 80 pp 63-65 manuscript received 22 Jan 79; after revision 23 Jul 79

VOLKOV, I. I. and BATISHCHEV, V. I.

[Abstract] Methods of correlation analysis based on the representation of the functions to be evaluated by a series on some orthogonal base occupy a significant place in the practice of statistical analysis of random processes. The quality of the evaluations obtained during this are determined by an entire series of factors and primarily by a kind of selected orthogonal

functions. Correlators with the approximation functions of Legendre and others, which have the broadest dissemination, can only solve problems of analysis for wide-band processes, the correlation functions of which have a weakly expressed oscillatory character. In other instances, in order to assure the necessary precision of approximation, one has to retain a large number of terms for expansion of the correlation functions, which leads to a considerable increase of the requirements on the apparatus and the statistical precision of the analyzer. The present short communication applies orthogonalized exponential functions in an approximate correlation analysis. An orthogonal filter is derived in the form of a transfer function. Realization of such a filter which has a canonical structure, on the basis of contemporary elements of integrated microelectronics, does not offer particular difficulties. Two algorithms are derived which make it possible to evaluate the parameters of the expansions of the correlation functions of a random process in the tempo of an experiment, during which storage in the memory of all the totality of values of the analyzable process is not required. The proposed algorithms can most effectively be used during development of the program means of a measuring and computing complex (IVK), a system with the use of minicomputers and microprocessors. The investigations showed that the proposed orthogonal basis is effective during analysis of processes with both monotonic and oscillatory correlation functions. References: 5 Russian.
[277-6415]

UDC 621.396.965.8

ERRORS OF A KALMAN FILTER WITH RESTRICTED WORD LENGTHS

Kiev IZV. VUZ: RADIOELEKTRONIKA in Russian Vol 23, No 5, May 80 pp 67-69 manuscript received 2 Apr 79; after revision, 1 Aug 79

KOVAL'CHUK, I. R. and BOGACHEV, Yu. I.

[Abstract] Expressions are obtained in this short communication for determining the errors of a Kalman filter with a restricted word length. This makes it possible to solve the question concerning choice of the necessary number of words during construction of a filter for secondary processing on a microprocessor element base. Figures 1; tables 1; references 3: 2 Russian, 1 Western (in translation).
[277-6415]

UDC 621.398

PARAMETERS PLANE METHOD OF TELETRANSMISSION FOR SYNTHESIS OF PULSE-CODE SYSTEMS OF TELEMETERING WITH VISUAL DISPLAY

Kiev IZV. VUZ: RADIOELEKTRONIKA in Russian Vol 23, No 5, May 80 pp 87-90 manuscript received 24 Jan 79; after revision, 24 Jul 79

BUTAYEV, G. M.

[Abstract] One of the most complex problems in the synthesis of pulse-code systems of telemetering (PCT) is the choice of the repetition period T_n and the category of n signals, inasmuch as the magnitude of certain error components of a PCT depends on the choice of T_n and n. The present short communication proposes a parameter plane method for determining the aggregate of pairs of T_n and n during synthesis of pulse-code systems of telemetering with visual display. Figures 1; references: 8 Russian.
[277-6415]

CERTAIN ASPECTS OF PHOTOGRAPHY, MOTION PICTURES AND TELEVISION

UDC 621.317:621.397.13

METHODS OF DETERMINING AND EVALUATING THE THROUGH SPECTRAL CHARACTERISTICS OF COLOR TELEVISION SIGNAL SENSORS IN A TV CENTER

Moscow TEKHNIKA KINO I TELEVIDENIYA in Russian No 6, Jun 80 pp 45-49

LOZHKIN, L. D., POSTARNAK, Ch. G., SUVOROV, G. A. and SHAPIRO, S. M.

[Abstract] Methods are described that have been used at Leningrad Telecenter to measure the through spectral characteristics $\sigma_i(\lambda)$ of color television signal sensors (cameras and projectors):

$$\sigma_i(\lambda) = \sum_{j=R,G,B,Y} c_{ij}\,\tau_j(\lambda)\,\varepsilon_j(\lambda),$$

where i = R, G, B, Y; c_{ij} are the elements of the color-correction matrix; τ_{ji} are the spectral transmission characteristics of the optical components of the sensors; $\varepsilon(\lambda)$ are the spectral characteristics of sensitivity of the photovoltaic elements of the sensors. The measurement results show that the through spectral characteristics differ from requirements under practical operating conditions, and vary for different sensors that are tested. Deviations of spectral characteristics from those specified by GOST State standards should be more strictly held within the admissible tolerances to bring the through spectral characteristics of color TV sensors closer together. In transmission, consideration must be taken of the change in spectral distribution of emission energy of studio light sources due to variation of the supply voltage. Mathematical modeling provides a means of more accurate determination of the through spectral characteristics of color TV sensors. Flowcharts are given for programs for calculating color distortions and for generating idealized reference spectra. Figures 6; references 8: 6 Russian, 2 Western.
[297-6610]

UDC 621.375.1

HIGH-SPEED LOGARITHMIC VIDEO AMPLIFIERS

Moscow RADIOTEKHNIKA in Russian Vol 35, No 6, Jun 80 pp 90-93 manuscript received 29 Oct 79

DRAZHEV, M. N. and RABOV, S. S., People's Republic of Bulgaria

[Abstract] Capacitive or transformer interstage coupling is generally used in single-channel logarithmic video amplifiers, which reduces the maximum repetition rate. These amplifiers generally have a dynamic range of about 60-80 or 10-15 dB/stage, and rise time is longer than 10-30 ns. In this article the authors describe comparatively simple and highly stable high-speed logarithmic video amplifiers with minimum recovery time using resistance-coupled stages. These devices have a wide dynamic range with little logarithmic error. A schematic diagram is given of a four-stage amplifier using wide-band differential stages (Czech integrated circuits type MA 3006). An additional operational amplifier (Czech integrated circuit type MAA 502) stabilizes the DC reference level at the output. Figures 4; references 10: 5 Russian, 5 Bulgarian.
[296-6610]

UDC 621.391.822:621.397.61:681.722.7

NOISES IN IMAGING EQUIPMENT USING CHARGE-COUPLED DEVICES

Moscow TEKHNIKA KINO I TELEVIDENIYA in Russian No 6, Jun 80 pp 51-57

MILENIN, N. K., All-Union Scientific Research Institute of Television and Radio Broadcasting

[Abstract] In semiconductor TV cameras based on charge-coupled devices (CCDs) the image quality depends to a considerable extent on the level and spectral composition of the noise that arises as the video signal is formed by the CCD. In this article the author gives the results of noise analysis based on a matrix CCD imaging unit with frame-synchronized charge transfer. The unit contains an accumulation section, a memory section, an output register, a tuned preamplifier, an output amplifier, a clock generator for controlling the entire CCD matrix, and also a generator of background charge inserted by optical, thermal or electrical means to improve the efficiency of charge transfer. Comparative analysis of various sources of noise reveals that the principal source in such an imaging device is the random

inherent noise in the CCDs. Expressions are derived for the spectrum of resultant noises. These expressions imply that the level of the noise and the shape of its spectrum vary with the numbers of the image elements, while spectral noise density is concentrated in the upper part of the spectrum and between the harmonics of the horizontal frequency, i.e., the noise spectrum is comb-shaped. A method is outlined for evaluating the weighted level of the noise in CCD imaging devices. Figures 5; references 22: 13 Russian, 9 Western.
[297-6610]

UDC 621.397.13:796.092.1(100)+654.19:796.092.1(100)

REVIEW OF RESEARCH DONE IN 1979 IN THE FIELD OF TELEVISION BROADCASTING EQUIPMENT

Moscow TEKHNIKA KINO I TELEVIDENIYA in Russian No 6, Jun 80 pp 3-9

PALITSKIY, V. M., DOLGOPOLOV, A. M. and LEONOV, I. V., Main Production and Engineering Administration of Gosteleradio SSSR [USSR State Committee of the Council of Ministers For Television and Radio Broadcasting]

[Abstract] In the Soviet Union in 1979 the average daily broadcasting of television programs reached 171 hours, including 71 hours of color broadcasts by Central Television. In early 1980 the television audience was 220.8 million, of which 165.9 million were receiving two or more programs. Research and design work in 1979 was being done in the following areas: development of third-generation studio equipment; series production of mobile television equipment; series production of newscasting equipment; development of new lighting facilities; development of fourth-generation digital TV equipment. The main efforts of the specialists at Gosteleradio SSSR have been aimed at setting up the television and radio complex for the Olympic Games. Figures 14; references: 10 Russian.
[297-6610]

UDC 778.534.45.001.4

INTRODUCTION OF THE NEW ZT-8 SOUND FILM AT THE LENFIL'M MOVIE STUDIOS

Moscow TEKHNIKA KINO I TELEVIDENIYA in Russian No 6, Jun 80 pp 28-30

GENINA, Ye. M., Lenfil'm Movie Studios

[Abstract] A report on tests of ZT-7 and ZT-8 sound film which was developed by the Shostkinskiy Branch of Gosniikhimfotoproyekt [State Scientific-Research Institute of the Chemical-Photographic Industry-project] and produced by the Shostkinskiy "Svema" Production Association. The film was successfully used by the Lenfil'm Movie Studios. The principal advantages of ZT-8 film are light sensitivity and wide latitude of compensation of nonlinear distortions with an optimum range of working densities extending far beyond that of ZT-7. The light sensitivity of ZT-8 film is nearly double that of ZT-7. White light is preferable for recording the sound track on ZT-8 film. The exceptional compensation of nonlinear distortions considerably relaxes the requirements for making copies with excellent sound, reducing the volumes of compensation testing, and saving appreciable time and materials. Figures 5; references: 3 Russian.
[297-6610]

COMMUNICATIONS, COMMUNICATION EQUIPMENT, RECEIVERS AND TRANSMITTERS, NETWORKS, RADIO PHYSICS, DATA TRANSMISSION AND PROCESSING, INFORMATION THEORY

UDC 519.24

SEQUENTIAL DETECTION OF SIGNALS WITH MEASUREMENT OF THEIR PARAMETERS

Moscow IZVESTIYA AKADEMII NAUK SSSR: TEKHNICHESKAYA KIBERNETIKA in Russian No 3, May/Jun 80 pp 130-137 manuscript received 6 Jun 78

TARTAKOVSKIY, A. G., Moscow

[Abstract] The problem of signal detection and estimation for a given maximum admissible observation time is considered. It is assumed that a many-step process is used with observations that are independent from step to step, and that are generally the result of analysis of some random process over a fixed time that can be assigned on each step. A method is proposed for processing these observations that minimizes the average risk for a loss function that depends on time both through the value of the experiment, and due to the possible time dependence of the observation of losses associated with terminal (resultant) solutions. It is shown that with certain restrictions, optimum analysis of the input process amounts to derivation of an averaged likelihood rule with respect to the unknown informative parameters, and comparing it with two variable thresholds that depend on the accuracy of the estimation. When the upper threshold is exceeded, a decision is made on the presence of a signal, and a parameter estimate is made that minimizes average losses. An example is given of the explicit form of the thresholds for detection of a gaussian signal against a background of white noise. Figures 1; references 12: 10 Russian, 2 Western.
[287-6610]

UDC 62-506

SIMULTANEOUS SEQUENTIAL DETECTION OF A SIGNAL AND ESTIMATION OF ITS PARAMETERS IN THE CASE OF A PRIORI INDETERMINACY

Moscow AVTOMATIKA I TELEMEKHANIKA in Russian No 3, Jun 80 pp 113-122 manuscript received 24 May 79

TARTAKOVSKIY, A. G., Moscow

[Abstract] The adaptive Bayes principle for controllable multistep processes is applied to simultaneous detection (sequential with cutoff) and estimation of a signal in the case of a priori indeterminacy and upper-limited possible number of measurement steps. A sequence of independent random quantities is assumed to represent either a mixture of signal and noise or noise alone. A decision rule minimizing the mean loss is sought, with the indeterminacy eliminated by replacement of the unknown parameters with their maximum-likelihood estimators. The problem is then reduced to an equation of dynamic programming for the minimum a posteriori risk. An adaptive algorithm is constructed accordingly for the case of an additive quadratic loss coefficient, extensible to any kind of loss coefficient, also for the important practical case of simultaneously detecting and estimating a correlated Gaussian signal of unknown power mixed with a Gaussian white noise of known intensity. The structure of a detection-estimation channel for this case is shown which includes an intraperiodic (preliminary) estimator and a 2-threshold resolver with a logarithmic amplifier. Figures 1; references 11: 8 Russian, 3 Western (1 in translation).
[301-2415]

UDC 621.311:519.21

MODELING OF RADIO WAVE PROPAGATION MEDIA ACCORDING TO A POSTERIORI STATISTICS OF A SPECIFIED FORM

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 25, No 5, May 80 pp 1093-1097 26 May 78

RODIMOV, A. P., OLYANYUK, V. P. and IGNATOV, V. V.

[Abstract] During an experimental investigation, as well as during modeling of media which incorporate in themselves sources of secondary emission (passive or active), the a posteriori probability characteristics of signals at the output of these media assume various distributions, depending both on the statistical properties of the media themselves and on the

statistical properties of the electromagnetic waves at the input of these media. In real situations the statistical properties of the media and the input signal are most correctly described by a stochastic process discussed in a 1959 paper by K.ITO. In the present paper, an algorithm is obtained which shows that for modeling the media for propagation of radio waves with a known generating statistic of the input process, it is necessary to introduce the measurable transfer functional $G(t, \theta_i)$ in the form of a control which makes it possible to obtain the model of propagation of practically any media. The methods necessary to place the process under consideration in correspondence with the stochastic differential equations of K.ITO are considered. By stabilizing the parameters of the a posteriori Gaussian distribution, it is possible to obtain from it a control which gives a dynamic model of a medium. The problem of identification of the media for propagation of radio waves reduces to construction of a system for control of the input distribution and measurement of this control. Methods existing at the present time are used for taking off determinate radiation at transmission and taking off of statistical characteristics at reception. Three examples are given of the determination of models of several known media for propagation of radio waves. Model 1: A Rayleigh model is taken for long-range tropospheric propagation of radio waves and a nonlinear stochastic equation is found (block diagram 1). Model 2: According to known data, the scattering process by hydrometers and water vapors in the millimeter waveband is described by a logarithmic normal distribution, for which a differential stochastic equation is found (block diagram 2). Model 3: From a physical point of view, the most complex is the process of propagation of short waves during their passage through the ionosphere. The most general class of distribution which is described by this process is the class of distributions which includes in itself Rayleigh, Routh and other distributions as partial cases (block diagram 3). Figures 3; references 8: 4 Russian, 4 Western (one in translation). [284-6415]

UDC 621.371

MODAL AND TIME STRUCTURE OF A DECIMETER SIGNAL

Moscow RADIOTEKHNIKA in Russian Vol 35, No 6, Jun 80 pp 67-70 manuscript received after completion 15 Oct 79

GORSHKOVA, E. Z., KIYANOVSKIY, M. P. and PODDEL'SKIY, M. P.

[Abstract] The paper gives the results of experimental studies of the modal and time structure of signals in the high-frequency band based on cumulative data for 1969-1976 on transmission paths in the middle latitudes ranging from 700 to 6400 km in extent, and on a high-latitude transmission path of 900 km. The results show that a refined quasiregular model of a high-frequency radio signal can be constructed that is suitable for reliable quantitative estimates in various applications. Analysis of modes and identification on the basis of vertical measurements by radiosonde systems shows that the beam approximation is adequate for calculating transmission paths, including localization of ionospheric regions traversed by a radio wave. References: 3 Russian.
[296-6610]

UDC 621.374.372

PULSE-FREQUENCY MODULATION SIGNAL TRANSCEIVER FOR AN OPTICAL COMMUNICATION LINE

Moscow RADIOTEKHNIKA in Russian Vol 35, No 6, Jun 80 pp 86-90 manuscript received after completion 5 May 79

KOSTEREV, V. S. and KOSTEREVA, E. P.

[Abstract] Optical communication lines must be economical with respect to energy on the transmitting side while maintaining high reliability and providing linear modulation and demodulation characteristics. These contradictory requirements are compromised in the proposed transceiver for a communication line based on a semiconductor emitter. The device uses electronic control of the modulator (blocking oscillator) on the transmitting side with linearization of the detector current in the receiver. This simplifies the circuit and to some extent removes the contradictions in requirements. The system operates on pulse-frequency modulation. The operation of the transceiver is explained with schematic, time and block diagrams. Tests show that the proposed circuit is applicable to both the optical and decimeter bands. Figures 4; tables 1; references: 7 Russian.
[296-6610]

UDC 621.382

FREQUENCY SHIFT BASED ON A GUNN DIODE

Moscow RADIOTEKHNIKA in Russian Vol 35, No 6, Jun 80 pp 42-44 manuscript received after completion 5 Sep 79

CHELYADIN, A. V.

[Abstract] An examination is made of the interaction between a weak microwave pulse signal and a supercritically doped load-stabilised Gunn diode. The Gunn diode was made of epitaxial n-GaAs with 10 μm active region and dopant concentration of about $3 \cdot 10^{15}$ cm^{-3}. The diode was installed in a waveguide cavity, resonant in the 3-cm wave band with one end electrically connected to the waveguide wall and a heat sink while the other end was connected through a filter to a pulse bias source. The bias voltage was about one and a half times the threshold voltage of diode oscillation. Then oscillation was dropped to the level of weak noise by an adjusting rod in the wide wall of the waveguide and an impedance transformer. A console oscilloscope and current transformer were used for monitoring the current through the diode. A weak signal with frequency equal to the pre-existing oscillations was applied to the diode through a circulator. As soon as the power exceeded a certain critical level, a radio pulse appeared in the output branch of the circulator with a slightly frequency. It is shown that as the level of the input signal is increased there is a stepwise change in the frequency and amplitude of the output signal. The author thanks I. I. Sokolovskiy for advice. Figures 4; references 13: 10 Russian, 3 Western. [296-6610]

UDC 621.391

COMPARING METHODS OF OPTIMIZING SYSTEMS WITH RESPECT TO VECTOR AND SCALAR CRITERIA

Moscow RADIOTEKHNIKA in Russian Vol 35, No 6, Jun 80 pp 32-34 manuscript received after completion 5 Nov 79

SERVINSKIY, Ye. G.

[Abstract] Optimization theory involves phases of formulation and calculation. The first phase is decisive because inadequate formulation will result in systems that are not optimum. In this paper the author compares the scalar and vector approaches to formulating optimization criteria based on a survey of the literature. The vector criterion gives the parameters

of quality of the system as the m coordinates of a vector in m-dimensional space. Optimization with respect to a vector criterion involves finding the set of admissible solutions that satisfy the initial constraints, dividing this set into two nonintersecting subsets, one of which includes all the "worse" solutions, and selecting the optimum solution from the other set. The scalar criterion assigns some function of the parameters of quality of the system, and optimization involves finding the extremum of this function, the major problem being the selection of the initial function. Comparison shows that in principle there is no reason to prefer one approach over the other. Figures 1; references: 23 Russian.
[296-6610]

UDC 621.391.1

SYNTHESIZER OF DATA SIGNALS WITH LOCALIZED FREQUENCY SPECTRUM

Moscow RADIOTEKHNIKA in Russian Vol 35, No 6, Jun 80 pp 15-21 manuscript received after completion 23 Apr 79

GALBIN, B. K.

[Abstract] Data transmission over channels with a limited passband involves coding numbers to a signal with limited frequency spectrum. This is done by amplitude, frequency and phase keying followed by spectrum limitation using an analog filter. The author solves the problem of synthesizing a signal in the form of a time series, which may be a Kotel'nikov series. This simplifies the analog filter and enables using one filter to shape different signals. The synthesizer can be made as an integrated circuit, and a transmission signal can be controlled in an additive communication system. It is shown that an interpolating pulse with given continuous finite frequency spectrum (the main data signal) can be approximated on a finite time interval by a sum of K weighted linearly independent functions. The spectrum of the resultant signal interpolates the given spectrum at K points. An example is given of calculation of the weighting coefficients (the spectrum in the given basis) by using the proposed approximation. It is shown that discrete spectra can be mapped as a bisection. Modifications of systems of harmonic functions are given. Practical results confirm the effectiveness of the proposed approximation in forming a signal for data transmission. Figures 5; references: 7 Russian.
[296-6610]

UDC 621.391.2

SOME CHARACTERISTICS OF ENSEMBLES OF PERIODIC DISCRETE SIGNALS WITH IDEAL CORRELATION FUNCTIONS

Kiev IZV. VUZ: RADIOELEKTRONIKA in Russian Vol 23, No 5, May 80 pp 55-58 manuscript received 16 Apr 79; after revision 3 Jul 79

IPATOV, V. P. and FEDOROV, B. V.

[Abstract] An investigation is made of ensembles of periodic discrete signals, the periodic correlation functions of which are ideal, i.e., they vanish for all aliquant lengths of displacement, and the maximum peaks of the periodic mutually correlative functions take the minimum possible values with such periodic correlative functions. References 4: 1 Russian, 3 Western.
[277-6415]

UDC 621.391.8

CONCERNING OPTIMUM RECEPTION OF A CLASS OF GAUSSIAN RANDOM PULSE SIGNALS AGAINST A NOISE BACKGROUND IN THE CASE OF PARAMETRIC A PRIORI INDETERMINACY

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 24, No 6, Jun 80 pp 1198-1202 manuscript received 28 Dec 78

RYBAKOV, B. S.

[Abstract] The Rayleigh, Hoyt, Rice, Beckman and generalized Gaussian models describe a broad class of signal propagation channels in randomly inhomogeneous media. The probabilistic mechanism of existence of a given model is determined by the characteristics of the transmission path and the conditions of propagation. Each of these models can be parametrically defined by using a generalized Gaussian model in terms of the ratio of average powers of the regular and fluctuation components of the signal $g^2 = (m_c^2 + m_s^2)/(\sigma_c^2 + \sigma_s^2)$, a coefficient that characterizes the skewness with respect to variances of the quadrature components $K^2 = \sigma_c^2/\sigma_s^2$, the phase angle of the regular component $\phi = \arctan m_s/m_c$, and the mean square $\eta^2 = m_c^2 + m_s^2 + \sigma_c^2 + \sigma_s^2$, where m_c, m_s, σ_c^2, σ_s^2 are the average values and variances of the normally distributed quadrature components. On actual transmission paths, these parameters change fairly slowly, and the time correlation functions of locally steady signal quadrature components are approximated by $R_c(\tau) = R_s(\tau) = e^{-a|\tau|}$, where τ is the time dispersion,

and 1/α is the correlation time. Thus for most propagation channels the values of g, K, φ, η, α can be taken as unknown, but constant over the observation period. Recurrent algorithms are found for the ratio of plausibility and filtration by using the method of synthesis of optimum receivers of Markov radio pulses within the framework of the adaptive Bayes approach. It is assumed that signals and noise belong to the class of periodically unsteady gaussian processes described by the generalized Gaussian model with parametric a priori indeterminacy. A block diagram of an optimum receiver is given. Figures 1; references 6: 5 Russian, 1 Western.
[292-6610]

UDC 621.391.8:510.5

QUASI-OPTIMUM ALGORITHM OF INCOHERENT SIGNAL DETECTION IN NONGAUSSIAN INTERFERENCE

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 24, No 6, Jun 80 pp 1305-1308 manuscript received 8 Jan 79

PYSHKIN, I. M. and CHVILEV, G. D.

[Abstract] An examination is made of the problem of detection of a signal S(t) with unknown initial phase distributed uniformly on the interval [-π, π] against a background of "white" Gaussian noise n(t) and interfering signals that coincide in structure with the useful signals. The phase distribution of the interfering signals has a uniform law on the interval [-π, π], and the times of appearance of interference on the interval of signal action [0, T] conform to Poisson distribution with a given intensity. It is assumed that the amplitudes of signals and interference are unknown. A signal detection algorithm is derived, and a receiver is proposed that is based on this algorithm. Formulas are derived for calculating the total probability of error of this receiver. It is shown that the proposed circuit realizes potential interference immunity that is independent of the ratio between noise and interference. Figures 2; references: 3 Russian.
[292-6610]

UDC 621.391.172

MULTICHANNEL DISCRETE FILTRATION IN THE CASE OF PERTURBATIONS IN THE CHANNELS

Moscow AVTOMATIKA I TELEMEKHANIKA in Russian No 3, Mar 80 pp 62-70 manuscript received 9 Apr 79

GRISHIN, Yu. P., Leningrad

[Abstract] A discrete random process describable by a linear difference equation is estimated according to the Bayes method, each of the channels in the multichannel system being at a given instant of time either operative or inoperative with the respective probabilities q_i and $1-q_i$. The state of each channel is characterized by a random sequence which can be constant and equal correspondingly to 1 or σ_i with the respective probabilities q_i and $1-q_i$. This sequence can also be one of independent random variables, which corresponds to an increase in the noise level during and due to measurements. Filtration algorithms and filters are constructed, optimal for the first case and suboptimal for the second case. As an illustrative example serves a 2-channel system with possible perturbations and with a scalar process describable by a first-order difference equation. Here a suboptimal nonlinear filter is found to be more reliable than an optimal linear one or a Kalman filter. Figures 3; references 6: 3 Russian, 3 Western.
[301-2415]

UDC 621.391.822:621.396.62

THE NOISE FACTOR OF A RECEIVER IN THE PRESENCE OF INTERFERENCE

Moscow RADIOTEKHNIKA in Russian Vol 35, No 6, June 80 pp 35-36 manuscript received 21 May 79

ALGAZINOV, E. K. and BOBRESHOV, A. M.

[Abstract] Currently used techniques for evaluating the noise factor of a receiver are not adequate for evaluation of sensitivity in the presence of strong interference. A new expression for the power factor is suggested that gives a more accurate idea of the change in sensitivity with interference: $\psi = K_{sup}/K_{bl}$, where the numerator is the coefficient of noise suppression equal to the ratio of the output noise power measured with nonzero input interference to the value measured without input interference,

and the denominator is the coefficient of blocking that characterizes the change in gain with interference, equal to the output signal power measured with non-zero input interference to the value measured without input interference. An example of application of this expression is given. Figure 1; references 2: 1 Russian, 1 Western (in translation).
[296-6610]

CALCULATION OF ELECTROMAGNETIC COMPATIBILITY OF MOBILE RADIO STATIONS

Moscow AVTOMATIKA, TELEMEKHANIKA I SVYAZ' in Russian No 6, Jun 80 pp 46-47

[Abstract] Recommendations are given on calculating the electromagnetic compatibility of mobile communication facilities with regard to interfering effects on the main channel and in adjacent frequency channels. Spatial separation between stations is determined from propagation curves showing the interference field strength as a function of distance. The mutual interference of two radio stations or networks can be disregarded if the ratio of the useful to the interfering signals at the reception point is greater than some specified value called the shielding ratio for a given length of time. The shielding ratio is taken as the minimum acceptable signal-to-noise ratio at the receiver input for which given communication quality is still realized. The following shielding signal-to-noise ratios at the reception point have been established for single-channel mobile networks in the decimeter wave band: +8 dB for networks operating in a combined frequency channel on the same frequency; -15 dB for networks operating in channels separated by half the frequency difference between adjacent channels; -50 dB for networks operating in adjacent frequency channels. Recommendations are given on preventing intermodulation. Figures 2.
[302-6610]

UDC 621.396.22:621.371.332.1:551.510.539:519.2

STATISTICAL MODEL OF A TWO-BEAM IONOSPHERIC SIGNAL

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 25, No 5, May 80 pp 1097-1100 manuscript received 9 Oct 78

KAYNARA, V. N. and ARTEMENKO, I. G.

[Abstract] A statistical model is considered of a narrow-band radio signal reflected from the ionosphere, which is the sum of two single signals each of which contains normal and random components. It is assumed that the single signals are propagated along individual trajectories (beams) and the probability density of each of them is described by the RAYS law. It is also assumed that the initial phases of quasi-regular (mirror-like) components are random functions of time and are distributed uniformly in the interval 0-π. The results obtained make it possible to conclude that the proposed two-beam model has large descriptive possibilities as compared with the most often used RAYS model and can be used during an analysis of structures and the probability properties of signals reflected from the ionosphere. Figures 2; references 5: 4 Russian, 1 Western.
[284-6415]

UDC 621.396:621.391.2

SIGNAL OPTIMIZATION IN MATCHED PROCESSING UNDER CONDITIONS OF CLUTTER

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 25, No 5, May 80 pp 970-974 manuscript received 5 Jan 79

KOSHEVOY, V. M., LISETSKIY, N. V. and SVERDLIK, M. B.

[Abstract] In problems of discrimination of signals on a background of clutter, choice of the form of the probing signal is important. A special place in this situation is where signal processing in the receiving channel is performed by a matched filter. Such processing, unlike matched processing, which in the general case is an optimum invariant to the magnitude of the clutter-to-noise ratio, has an additional advantage during practical construction of systems because one and the same electrical network can be used for production of the signal and for its processing. Although an integral equation for the optimum signal is obtained in a number of works in the literature, up to now sufficiently substantiated methods for its solution are lacking. The present paper develops two iteration methods of synthesis of signals, intended for matched processing in the receiving channel.

The problem of the convergence of iteration processes of optimization was examined with the use of a digital computer. The investigations made with different initial approximations show that the method of successive approximations assures convergence of the iteration process independent of the choice of initial approximations, both for an equation on the basis of an inverse operator and for an equation on the basis of a supplemental zone. During this, in the general case the rate of convergence for the two methods is different. When the size of the area of the interference zone is less than the inverse operator N, the rate of convergence of the iteration process in the case of an approach on the basis of an inverse operator becomes higher than in the case of a supplementary zone. However, allowing for the fact that with an increase of the base, the signals being optimized increase the difficulties connected with the necessity for calculation of the inverse operator, use of an approach on the basis of the supplementary zone is found to be preferable from the point of view of the overall time expenditure of a digital computer on a solution of the problem of synthesis. References 6: 4 Russian, 2 Western.
[284-6415]

UDC 621.396.61:621,396.2

DETERMINATION OF HIGH-FREQUENCY SIGNAL DISTORTIONS UNDER FOURIER TRANSFORMATION WITH SPECTRUM LIMITATION

Kiev IZV. VUZ: RADIOELEKTRONIKA in Russian Vol 23, No 5, May 1980 pp 37-41 manuscript received 19 Feb 79; after revision 19 July 79

DRAPITS, V. A. and KOVALEVSKIY, E. A.

[Abstract] During analysis of radio engineering systems by the method of mathematical modeling, the initial data for construction of a design model are often the experimental frequency characteristics of high-frequency devices obtained in the limited zone of frequencies Ω_1, Ω_2, $\Omega_1 > 0$, $\Omega_2 < \infty$. The time representation of a signal which has passed through such a device is obtained with the aid of a Fourier reconversion. However, it is known that the signal obtained is physically not realizable because it is infinite with respect to duration and originates the earlier arrival of the input signal, i.e., it is distorted with respect to a signal, unlimited with respect to spectrum. During evaluation of the quality of the models for a number of systems, it is essentially necessary to determine these distortions in the time intervals, irrespective of the duration of the signal. The present paper derives an asymptotic expression for determining the distortions of the time representation of a high-frequency signal with a two-way limitation of its spectra. A mathematical model using the Fourier transformation is proposed. The range of applicability of the

asymptotic expression is determined by two examples: 1) Determination of the error of time representation of a radio pulse with a rectangular envelope; and 2) Consideration of the distortion of a linear frequency modulated pulse signal. Figures 3; references 3: 2 Russian, 1 Western (in translation).
[277-6415]

UDC 621.396.93:681.323

DETERMINING THE DURATIONS OF RADIO PULSES WITH SMOOTHLY VARYING ENVELOPES FROM THEIR AMPLITUDE SPECTRA

Novocherkassk IZV. VUZ: ELEKTROMEKHANIKA in Russian No 5, May 80 pp 439-444 manuscript received 4 Apr 78

BARMETOV, Yu. P., junior research worker, Voronezh Technological Institute; YEVTEYEV, Yu. I., candidate in technical sciences, dotsent, Voronezh Technological Institute; and KUSHCHEV, B. I., candidate in physicotechnical sciences, professor, rector, Voronezh Technological Institute

[Abstract] Use of a digital computer and a discrete Fourier transformation of the amplitude spectrum is considered for determination of the duration of a radio pulse with a smoothly varying envelope. The procedure is applied here to radio pulses with a rectangular, sinusoidal, or $\sin^2$-envelope. In each case the signal is assumed to be a narrow-band one, with the carrier frequency much higher than the width of the envelope spectrum. The duration scale factor is almost constant, for a given power exponent in the Fourier series, over a wide range of pulse durations (ratio of pulse period to time discretization interval) but differs for the various envelopes. A sufficiently high accuracy is attainable without taking into account all harmonics in the Fourier series, fewer harmonics being necessary with a higher power exponent and for a narrower envelope spectrum. Figures 2; tables 3; references: 2 Russian.
[303-2415]

UDC 621.396.96

CORRELATION CHARACTERISTICS OF NOISELIKE SIGNALS

Kiev IZV. VUZ: RADIOELEKTRONIKA Vol 23, No 5, May 80 pp 95-97 manuscript received 23 Apr 79; after revision 10 Sep 79

CHECHIK, L. A.

[Abstract] Applications of a narrow-band Gaussian process are used in radio communication systems as noiselike signals. This short communication investigates the distribution nature of the two-dimensional correlation function of such signals for the case where the spectrum of the initial Gaussian process is constant in the frequency band Δf_0. The medium frequency of the spectrum is equal to f_0, $f_0 \gg \Delta f_0$. Outside of the band Δf_0, the spectral density equals zero. References: 4 Russian.
[277-6415]

UDC 621.397

CHARGE INVERSION IN CHARGE-COUPLED DEVICES

Moscow RADIOTEKHNIKA in Russian Vol 35, No 6, Jun 80 pp 10-14 manuscript received after completion 3 Dec 79

AMINEV, A. M., SULTANOV, A. Kh., TIMOFEYEV, A. I. and KOVALEV, Yu. I.

[Abstract] Charge-coupled devices (CCD) are being more and more widely used in analog signal processing equipment. In the general case, signal processing in such devices involves the following major operations: 1) Quantizing the input signal; 2) Capacitor charge storage; 3) Charge transfer from one capacitor to another; 4) Charge readout from the output storage capacitor; 5) Charge multiplication by a given number (weighting); and 6) Reconstruction of the analog signal from the sequence of samples. A technique is proposed for improving the effectiveness of using CCDs in analog devices by reducing the error of signal input/output operations and the error of multiplication. This method involves charge transfer with change of sign, which enables charge inversion, i.e., multiplication by -1 and subtraction of charges with an error of the order of the loss of charge in one transfer. A schematic diagram and time diagrams are given for a charge-inverting circuit based on bipolar bucket brigades. Measurement results show an inversion error of from 0.4 to 1.5% with an input charge range of 10-50 pC. Figures 3; references 5: 3 Russian, 2 Western.
[296-6610]

UDC 658.011.46:656.254.16:621.396.4.004.69

EFFECTIVENESS OF UPDATING RADIO RELAY LINES IN THE MINISTRY OF RAILROADS

Moscow AVTOMATIKA, TELEMEKHANIKA I SVYAZ' in Russian No 6, Jun 80 pp 31-33

CHRIKOV, G. D., chief project engineer, Gidrotranssignalsvyaz'

[Abstract] An economic analysis is made of the effectiveness of updating radio relay lines in the Ministry of railroads by replacing old and obsolescent equipment or entire relay systems, and also by repairing and modifying existing equipment. The investments in the active part of fixed capital increase to 85-90% as compared with the 30-35% invested in new construction. This accelerates the growth of labor productivity per unit of capital investment. The reconstruction of radio relay lines has other advantages over new construction: increased capacity of the lines, shorter construction periods, more rapid payoff of investments, maximum utilization of the knowledge of specialists and collectives of skilled workers, improvement of labor organization and better working conditions. A specific example of the effectiveness of reconstruction is given by figures on the Gor'kiy Railroad: staff reduction--56%; increase in number of channels--550%; increase in labor productivity--1250%; savings of metal--5 metric tons; savings of electric power--doubled; reduction of overhead--cut in half. Tables 2.
[302-6610]

COMPONENTS AND CIRCUIT ELEMENTS, WAVEGUIDES, CAVITY RESONATORS AND FILTERS

PULSE-DURATION MODULATION FOR THYRISTORIZED REGULATORS

Moscow RADIO in Russian No 4, 1980 p 25

GOLOBOV, A. [deceased], Moscow

[Abstract] The thyristorized power regulators now used in resistance furnace control are based on pulse-phase modulation with a comparatively low power factor when the duty factor is high. Such regulators cause considerable interference in power supply circuits. The author proposes power control by pulse-duration modulation in which the thyristors operate as switches with a discrete change in angle of flow. Such a modulator generates square controlling pulses with variable duty factor that are fed to the input of the thyristorized regulators to control the voltage across the load. The average power released in the load is equal to the product of the duty factor multiplied by the nominal power of the facility. Regulation ranges from 20 to 100% of the nominal power. Schematic and time diagrams are given and the operation of the modulator is explained. Radio interference is virtually eliminated because switching is synchronized with the time when the instantaneous value of the line voltage is at zero. Figures 2.
[291-6610]

UDC 536.8.08:536.5.08:621.317.7

A COAXIAL-WAVEGUIDE TYPE THERMAL NOISE GENERATOR

Moscow IZMERITEL'NAYA TEKHNIKA in Russian No 5, May 80 p 69

RESHETNIKOV, O. M.

[Abstract] Bolometric power converters have noise characteristics which make them suitable as thermal noise generators, if the power loss can be increased substantially. This is possible with a closer coupling between the hot tungsten wire and the waveguide channel. Here a construction is shown where the thin bolometer wire constitutes the inner conductor of a

coaxial waveguide. The coefficients of the scattering matrix for such a waveguide, containing a lossy inhomogeneity with the resultant admittance Y_r and a lossless transition, are $s_{11} = -Y_r/(2+Y_r)$ and $s_{12} = 2/(2+Y_r)$. For a typical waveguide channel with a 35x15 mm² cross section, an inner conductor 3 mm in diameter and an outer conductor 6 mm in diameter, the voltage standing-wave ratio $K_{SWR} = (1+|s_{11}|)/(1-|s_{11}|)$ decreases asymptotically to approximately 1.35 and the attenuation $B = 10 \log |s_{12}|^2$ decreases asymptotically to approximately 0.9 dB as the microwave frequency increases over an operating range from 5.5 to 8.35 GHz. Figures 2; references: 3 Russian.
[290-2415]

UDC 621.78.02

PROBLEMS IN THE DESIGN OF INVARIANT SYSTEMS WITH A RELAY ELEMENT

Novocherkassk IZV. VUZ: ELEKTROMEKHANIKA in Russian No 5, May 80 pp 482-486 manuscript received 11 Sep 78

DOROGOV, V. N., candidate in technical sciences, Dotsent, Moscow Institute of Electrical Machine Building

[Abstract] A relay system invariant with respect to changes in the transfer ratio and in the time constant of a first-order linear control object is considered for operation in the oscillatory mode between two limit levels with external synchronization. The problem of designing such a system is analyzed in terms of the frequency characteristic and the amplitude relations. A practical example of such a system is an automatic regulator of the heat treatment process for glass-plastic materials. Figures 2; references: 5 Russian.
[303-2415]

UDC 621.318.2

VALIDATION OF THE 2-FLUX INSPECTION PROCEDURE FOR PERMANENT MAGNETS MADE OF HIGH-COERCIVE MATERIALS

Novocherkassk IZV. VUZ: ELEKTROMEKHANIKA in Russian No 5, May 80 pp 534-536 manuscript received 5 Apr 78

VASIL'YEVA, V. A. and MARTYNOV, V. V.

[Abstract] The demagnetization curve for high-coercive permanent magnets is linear through almost the entire second quadrant, which makes inspection by measurement of the magnetic flux at two operating points feasible. On the basis of the $(H-H_1)/(H_2-H_1)=(\Phi_1-\Phi)/(\Phi_1-\Phi_2)$ equation with $\Phi_1=H_1k_1$ and $\Phi_2=H_2k_2$ the H,Φ coordinates of the point corresponding to the maximum energy product are also determined and then the remnance and the fictitious (extra-polated) coercive force. The somewhat lower real coercive force is determined with the aid of two correction factors, one accounting for the nonlinearity of the demagnetization curve in this vicinity, and one of correlation with experimental data. Numerical values of these factors are given for grades 2BA1, 1BI, 2BA barium ferrite and grades KS37, KS37A samarium-cobalt alloy. Figures 1; tables 1; references: 2 Russian.
[303-2415]

UDC 621.318.134.029.64:519.237.4

DISPERSION EQUATION FOR LAMINATED METAL-FERRITE STRUCTURE

Kiev IZV. VUZ: RADIOELEKTRONIKA in Russian Vol 23, No 5, May 80 pp 74-75 manuscript received 12 Feb 79; after revision 24 Sep 79

KALINIKOS, B. A. and MITEVA, S. I.

[Abstract] Delay lines using the effect of the propagation of spin waves in ferrite films (e.g., yttrium-iron garnet) have found use in the microwave band. The problems of an analysis of the spectra of spin waves in various laminar structures on a basis of magnetic films have repeatedly been covered in the literature. However, the question of the form of the structure of a spin wave for the general case of the laminated structure metal--insulator--ferrite--insulation--metal is of some interest because just such structures are used in real designs of delay lines. In the present short communication a laminated structure is studied which consists of a ferrite film tangentially magnetized up to saturation along the z axis, separated on two sides from the conducting surface by two insulating layers

of different thicknesses. Consideration is restricted to the interval of values of the wave numbers from 10^3 to 10^5 cm^{-1}, in which the magnetostatic approximation holds true. Because in practice comparatively long spin waves (with $k_z < 10^4$ cm^{-1}) are used, then during construction of a delay line, a metal surfacing can increase the delay time. Figures 3; references 4: 1 Russian, 3 Western.
[277-6415]

UDC 621.352

A TRIPLE-LAYER MAGNETOSTRICTIVE ELEMENT

Novocherkassk IZV. VUZ: ELEKTROMEKHANIKA in Russian No 5, May 80 pp 478-481 manuscript received 24 Feb 78; after completion, 30 Aug 78

NAMITOKOV, K. K., doctor of technical sciences, professor, Khar'kov Institute of Public Structure Engineers; and TERESHIN, V. N., graduate student, Khar'kov Institute of Public Structure Engineers

[Abstract] Bimetallic magnetostrictive elements are subject to flexure not only caused by magnetostrictive forces but also by changes in the ambient temperature. Here addition of a third layer (of a nonmagnetic material) on one side is considered as means of thermal compensation. Such a triple-layer strip fixed at one end is treated as a cantilever beam and from the appropriate deflection equation the necessary thickness of the compensating layer is calculated. Numerical results obtained with the aid of a computer for a strip consisting of a 0.5 mm thick layer of 50 KF steel between a 0.5 mm thick layer of N2 nickel and a layer of L-62 brass indicate that the brass layer should be 0.4 mm thick and that such an element is much more sensitive than a plain bimetallic element. Figures 2; references: 4 Russian.
[303-2415]

UDC 621.372.2

USE OF PERTURBATION METHOD FOR CALCULATION OF THE ELEMENTS OF THE TRANSMISSION MATRIX OF A MULTICONDUCTOR LINE IN A NONUNIFORM DIELECTRIC

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 25, No 5, May 80 pp 1079-1080 manuscript received 21 Sep 78

VERSHININ, I. M. and VOROB'YEV, P. A.

[Abstract] Use of large integrated circuits in high-speed computers and microstrip lines in microwave units leads to the problem of calculating the transmission matrix of a multiconductor line in a nonuniform dielectric. Recording of its elements is connected with finding the phase velocity of the normal waves $v_i=\sqrt{1/\lambda_i}$ being propagated (λ_i = the characteristic values of the matrix product of the linear inductance and the linear capacitance of the line LC) and also of the matrix of H, the columns of which, h_i are the characteristic vectors of LC and reflect distribution of the voltage amplitudes in the conductors for corresponding normal waves. With known matrices, L and C are required in order to solve the indicated problem for characteristic values. Numerical methods for its solution are time consuming and are derived of clear representation. The present paper proposes a perturbation method which makes it possible to overcome these disadvantages. It is shown that the proposed method leads to a reduction of the time for calculation of the elements of a transmission matrix because analytical expressions are used for the initial approximation. By virtue of the smallness of matrix B they make it possible with sufficient precision to evaluate the phase velocity and the expected distribution of amplitude, as well as to analyze their possible conduct during change of linear parameters. The independence of the characteristic vectors of the L'C' matrix chosen from the value of its elements (as in the case of a doubled connected line with identical conductors) gives a significant economy of calculation time during optimization of units, connected with a change of the dimensions of the lines. References 10: 7 Russian, 3 Western. [284-6415]

UDC 621.372.2.001.24

OPENING AT END OF MICROSTRIP LINE

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 25, No 5, May 80 pp 1084-1087 manuscript received 1 Dec 78

NEFEDOV, Ye. I., NEFEDOV, I. Ye. and FIALKOVSKIY, A. T.

[Abstract] One of the principal problems in the construction of the electrodynamic foundation of computer-aided design of microwave integrated circuits is the problem of calculating the scattering matrices of typical nonuniform microstrip lines (MSL). An opening at the end ($z=0$) of a MSL is widely used in integrated circuits and consequently an electrodynamic analysis of it is important. In the present short communication an analysis is made of the phenomena at the open end of a MSL during the incidence on it of a quasi-TEM wave with $kd \sim 1$ within the framework of the Oliner method. (Here d is the thickness of the dielectric layer, the substrate of a MSL; and $k = k_0\sqrt{\varepsilon\mu}$ where ε, μ are the relative electrical and magnetic permeability of the substrate, $k_0 = 2\pi/\lambda = \omega/c$, the wave number in a vacuum.) A comparison of the numerical results obtained here for the scattering matrices of the open end of a nonsymmetrical MSL, with the known results from a model with a "cover" shows an obvious inadmissibility of the use of such a "closed" model for calculations of the diffraction characteristics of an open end MSL. Figures 3; references 9: 7 Russian, 2 Western.
[284-6415]

UDC 621.372.8.001.24

RESONANT CHARACTERISTICS OF AN EVANESCENT WAVEGUIDE SECTION WITH A DIELECTRIC LAYER

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 24, No 6, Jun 80 pp 1283-1286 manuscript received 26 Jun 78

BERGER, M. N., KAPILEVICH, B. Yu. and SIMIN, N. S.

[Abstract] Resonant phenomena in evanescent waveguides are extensively used in developing miniature frequency-selective microwave devices. These effects come about when conductive or dielectric inhomogeneities are inserted in the evanescent waveguide. In this article the authors consider the influence that the geometry of a waveguide—dielectric structure has on the resonant characteristics of the system, and on the longitudinal

distribution of the field. Fused quartz was used as the flat dielectric layer. The dielectric layer was located in a rectangular evanescent waveguide of given width, excited by the fundamental mode of another rectangular waveguide of different width. The heights of the two waveguides are the same. Expressions for the elements of the S-matrix are found from the condition of continuity of the transverse components of the electric and magnetic fields on the interfaces of the media and in the input and output cross sections. Electric field distributions are given as calculated by the formula derived in the paper. The nature of the field distribution is similar to that in cavity waveguides. Figures 4; references 7: 5 Russian, 2 Western.
[292-6610]

UDC 621.372.8.049.75-419

ALGORITHMIZATION OF PROBLEM OF PROPAGATION OF WAVES IN MICROSTRIP STRUCTURES WITH GYROMAGNETIC LAYERS (TRANSVERSE MAGNETIZATION IN THE PLANE OF THE LAYER)

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 25, No 5, May 80 pp 930-939 manuscript received 13 Nov 78

GLUSHCHENKO, A. G., KURUSHIN, Ye. P., NEGANOV, V. A., NEFEDOV, Ye. I. and SANTALOV, N. P.

[Abstract] A generalized shielded transmission line with an arbitrary number of current-conducting strips on a multilayer substrate of gyrotropic and isotropic layers is studied. The problem reduces to a system of Fredholm integral equations for the electrical and magnetic currents, the algebraization of which is produced by the Galorkin method. With the object of accelerating convergence of the results, additional terms are introduced into the system of basic functions, taking into account the distinctive features of currents at the edges of the strip and slots. Earlier a similar method was developed for a nonsymmetrical strip line on a ferrite substrate and on a dielectric substrate, so that the present work is their generalization for multilayer structures. The approach used in the work to a calculation of complex transmission lines on combined anisotropic substrates makes it possible in a number of cases to realize the program, even on computers of average power. The program of calculation of an inverted strip line, for example, on the extremely low-powered computer, the YeS-10-20, requires 30-40 seconds of computer time. Figures 3; references 12: 8 Russian, 4 Western.
[284-6415]

UDC 621.372.58

Q OF GYRATOR INDUCTANCE

Kiev IZV. VUZ: RADIOELEKTRONIKA in Russian Vol 23, No 5, May 1980 pp 90-91 manuscript received 5 Mar 79

BALITOV, M. S. and SENICHEV, A. V.

[Abstract] The Q of a simulated inductance is considered with the assumption that the gyrator is nonideal, and the input and output resistance of the gyrator does not equal zero. It is also assumed that the gyration resistance is not purely active and has a negative phase shift. The equivalent circuit is presented of a gyrator from the side of the input terminals with all nonideal points taken into account. The optimum frequency and maximum Q are determined. Figures 1; references 1.
[277-6415]

UDC 621.372.413.029.6.018.756

FORMATION OF POWERFUL PULSES WITH ACCUMULATION OF MICROWAVE ENERGY IN A RESONATOR

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 24, No 6, Jun 80 pp 1227-1230 manuscript received 9 Jan 80

DEVYATKOV, N. D., LIDENKO, A. N., ZAMYATINA, L. Ya., RAZIN, S. V. and YUSHKOV, Yu. G.

[Abstract] The paper gives the results of experiments on formation of powerful microwave pulses of nanosecond duration by accumulation of energy in a nonsuperconductive standing-wave resonator. The source was a frequency-tunable oscillator in the 10-cm band with output power of 1.6 MW and pulse duration of $3 \cdot 10^{-6}$ s. The microwave energy was accumulated in a waveguide bounded at one end by the element of excitation of the supply channel, and on the other by a tee of H-type. One of the arms of the tee was shorted and had a length of twice the wavelength of the waveguide. The tee was tuned to the cavity frequency by slight displacement of the shorting wall. Decoupling between the arms of the tee connected to the cavity and the output load was at least 40 dB. The cavity was switched from energy accumulation to extraction by igniting a microwave discharge spark in the shorted arm of the tee. Energy accumulation was monitored by two oscilloscopes showing detected pulses from the cavity and the output waveguide. The electric strength of the cavity was increased by

evacuation, or by pressurizing with SF_6 and nitrogen. The output pulses had duration of 15 ns and power of 70 MW with power gain of 18 dB over the supply oscillator. The efficiency of coupling out the accumulated energy reached 18%. The overall efficiency of conversion of the oscillator energy to nanosecond pulse energy was about 30% because no special steps were taken to increase efficiency of input. Figures 2; references 8: 5 Russian, 3 Western.
[292-6610]

UDC 621.3.011.73

SYNTHESIS OF FILTERS WITH MAXIMALLY FLAT AMPLITUDE-FREQUENCY RESPONSE AND EQUALIZED ATTENUATION IN THE STOPBAND

Moscow RADIOTEKHNIKA in Russian Vol 35, No 6, Jun 80 pp 57-60 manuscript received 20 Aug 79

VITKOV, M. G.

[Abstract] Filters with the flattest possible response in the passband are synthesized that are superior to Butterworth filter networks in selectivity and have more rapid increase of attenuation outside the passband. The author uses a previously developed method to compile a computer program for equalizing the working attenuation of the filters in the stopband with arbitrary piecewise continuous weighting functions. Such programs are used to design maximally flat filters with symmetric and asymmetric amplitude-frequency characteristics and with different levels of attenuation in different regions of the stopband. The pulse characteristics of the proposed filters are evaluated. Figures 3; tables 5; references 9: 6 Russian, 3 Western.
[296-6610]

UDC 621.372.54

REJECTION SURFACE-ACOUSTIC-WAVE FILTER

Kiev IZV. VUZ: RADIOELEKTRONIKA in Russian Vol 23, No 5, May 80 pp 69-72 manuscript received 14 Mar 79; after revision 4 Jun 79

ZNAMENSKIY, A. Ye. and MURATOV, Ye. S.

[Abstract] One of the principal advantages of the technique of surface acoustic waves is the possibility of simple methods to realize arbitrary forms of the amplitude-frequency response (AFR). The special form of the AFR considered in the present short communication is a combination of the band-pass and rejector types. A simple and compact method is examined for synthesis of an AFR for a band of frequencies below 30 MHz, based on subtraction of two AFR of the band-pass type with various pass bands. A block diagram is presented of the counter-pin converter [VShP] (CPC) of a filter which realizes the required AFR. On the basis of this block diagram two filters were developed with an AFR of the type of AFR mentioned above, at the average frequencies of 6.6 and 26.4 MHz, intended for measurement of the extra-band pass noise of an intermediate frequency amplifier. As an acoustic line, plates of niobate lithium were used with a yz sector measuring 32 x 20 x 2 mm, on which by the photolithography method of chemically precipitated silver, 0.08 micrometer thick, was applied to the structure of the CPC. Details of the filters are presented. Figures 4; references 5: 3 Russian, 2 Western.
[277-6415]

UDC 621.372.852.1

AN EVANESCENT WAVEGUIDE-DIELECTRIC STRIPLINE FILTER

Moscow RADIOTEKHNIKA in Russian Vol 35, No 6, Jun 80 pp 76-79 manuscript received 25 Jul 79

BERGER, M. N., KAPILEVICH, B. Yu. and SIMIN, N. S.

[Abstract] A stripline filter is proposed with a waveguide-dielectric resonant device in the form of a rectangular evanescent waveguide with a flat dielectric layer. The waveguide is located on the backing of the stripline, which protrudes a short distance into the cavity at the input and output. Slots are made in these sections to accommodate the narrow walls of the waveguide. The lower wide wall is a continuation of the

shield plate of the stripline. The stripline conductor is electrically connected to the upper wide wall of the waveguide through a rod of approximately the same diameter as the width of the stripline conductor. The dielectric layer completely fills the cross section of the evanescent waveguide. The frequency characteristics of the proposed microwave device are analyzed. Figures 3; references 8: 7 Russian, 1 Western.
[296-6610]

UDC 621.396.96:621.391.26

CHARACTERISTICS OF SWITCHABLE FILTERS

Moscow RADIOTEKHNIKA in Russian Vol 35, No 6, Jun 80 pp 60-63 manuscript received 4 Feb 80

KURILKIN, V. V. and MIRONOV, A. F.

[Abstract] In coherent signal reception, signal processors can be based on using switchable filters in which the waveforms are artificially damped after a certain time (the switching interval). The authors examine the qualitative and quantitative characteristics of receivers based on such filters, specifically: 1) The way that the working characteristics of the receiver depend on the passband of the filter in the static state, the switching interval of the filter and detuning of the signal frequency relative to the filter frequency; and 2) The way that the switchable filter band depends on the switching interval for filters with different types of amplitude-frequency response. The analysis is based on a circuit in which the input signal goes through a switchable filter, a detector and an integrator to one input of a comparison circuit, where it is compared with the output voltages from a number of analog circuits. It is shown that switchable filters can improve receiver characteristics in communication systems because losses in the signal-to-noise ratio when the filter is not matched to the signal can be reduced by changing the switching period of the filter. Formulas are given for engineering calculations of filter characteristics. Figures 5; references 6: 5 Russian, 1 Western.
[296-6610]

THE FPIP-049a AND FP1P-049b PIEZOCERAMIC FILTERS

Moscow RADIO in Russian No 4, 1980 p 60

KHARITONOV, V. and ABLOGIN, V., Moscow

[Abstract] The new FP1P-049a and FP1P-049b piezoceramic filters are designed for use in the i-f channels of class II and III decimetric-wave receivers. The width of the passband on the 6 dB level is 150-200 kHz for the FP1P-049a, and 200-280 kHz for the FP1P-049b. Middle frequencies are 10.60, 10.65, 10.70, 10.75 and 10.80 MHz as indicated by dot colors marked on the casing, with tolerance of ±30 kHz. Response is flat on the 6 dB level and has a slope of no more than 12 dB/kHz on the 26 dB level. Input and output impedance is 330 ohms, maximum signal voltage at the input is 1.5 V, and the working temperature range is from -25 to +50°C. Figures 3. [291-6610]

UDC 621.396.42

PROBLEMS OF SEARCH THEORY OF PHYSICALLY REALIZABLE STRUCTURES FOR FREQUENCY SYNTHESIS

Kiev IZV. VUZ: RADIOELEKTRONIKA in Russian Vol 23, No 5, May 80 pp 3-9 manuscript received 6 Apr 79

YAMPURIN, N. P.

[Abstract] Problems of the search for physically realizable structures for frequency synthesis (SFS) are investigated. The SFS analyzed consist of series-connected identical sections, a block diagram of which is shown. The basic results of the work lead to the following: 1) For an analysis and calculation on a computer of the process of frequency conversion, it is proposed to use a mathematical device based on the introduction of a new class of characteristics of mixer-identifiers of the forms of frequency conversion; 2) With the use of identifiers of the form of frequency conversion, a theorem is proved concerning the physical realizability of the series-connected structures of frequency synthesis based on a unique series of forms of frequency conversion with a specified number of mixers with subtraction of frequencies; and 3) A new algorithm of search for physically realizable structures for frequency synthesis is developed, based on a change of the forms of the subtraction of frequency in the mixers, displays its advantages in comparison with the method of a direct surplus of all the great number of forms of frequency conversions of the frequency mixers.

The results obtained can be used during construction of frequency converters in spectrum analyzers, comparators and in ring automatic phase control (if a closed input and output of a section is assumed). Figures 2; references 7: 5 Russian, 2 Western.
[277-6415]

UDC 621.396.966

EFFECT OF PRECISION OF MANUFACTURE OF ELECTRODES ON LOSSES IN A MATCHED FILTER FOR A COMPLEX SIGNAL BASED ON SURFACE ACOUSTIC WAVES

Kiev IZV. VUZ: RADIOELEKTRONIKA in Russian Vol 23, No 5, May 80 pp 31-36
manuscript received 3 Nov 78; after revision 3 Jul 79

SMIRNOV, N. I. and KARAVAYEV, Yu. A.

[Abstract] The effect is considered of the precision of manufacture of the metal electrodes, the so-called counter-pin converters (CPC), in a matched filter based on surface acoustic waves (SAW) on the power losses of a useful signal. The sequence of operations in the production of matched filters based on SAW is explained, and the sources of the power losses of a useful signal are considered. The dependence of the power losses on various errors during manufacture is shown. The effect of the precision of manufacture of the electrodes of CPC on the characteristics of devices based on SAW must be taken into account during manufacture, not only of matched filters for a complex signal, but also during manufacture of bandpass filters with minimum width of the bandpass. Figures 2; references: 5 Russian.
[277-6415]

CONFERENCES, SEMINARS, EXHIBITIONS, SYMPOSIUMS

UDC 621.3.064.4:061.3

FIFTH SEMINAR ON PHYSICS OF ARC QUENCHING IN HIGH-VOLTAGE CIRCUIT BREAKERS

Moscow ELEKTRICHESTVO in Russian No 6, Jun 80 pp 75-76

LEPER, D. P.

[Abstract] At the last regular seminar (26-29 Jun 79 at Moscow) under the auspices of the Scientific Research Center for High-Voltage Equipment, Minergo [USSR Ministry of Power and Electrification], 25 reports from 14 institutions were delivered. The reports on results of experimental studies dealt with a.c. arcs in transformer oil (N. V. SHILIN and V. P. IGNATKO discovered anomalously high electric field intensities up to 5.5 kV/cm at discharge currents of 70-110 kA, anomalously high rates of voltage rise up to 0.5 kV/μs far from a current zero crossover, and a quasi-static pressure peak up to 3 MPa during the first current peak) and arc quenching by means of explosives, also the design and the performance of various arc quenching devices. The reports on results of theoretical studies represented the two prevalent and mutually complementary approaches to arc quenching, namely: the "physical" approach from the standpoint of discharge plasma and magnetohydrodynamics, and the "cybernetics" approach from the standpoint of automatic control systems and adaptive simulation. Two separate reports dealt with special topics: one with the recovery of electrical strength, one with the factors limiting commutation in explosion-type arc quenchers with inductive energy storing devices.
[298-2415]

CONVERTERS, INVERTERS, TRANSDUCERS

UDC 53.087.97.082.73:620.179.16.05

A TEST STAND FOR MEASURING THE CHARACTERISTICS OF ULTRASONIC PIEZOELECTRIC TRANSDUCERS

Moscow IZMERITEL'NAYA TEKHNIKA in Russian No 5, May 80 pp 70-72

BAKSHEYEV, V. G., DUZENKO, V. A., KRIVOSHEYEV, I. A., PAL'SHIN, G. N. and PANIN, V. I.

[Abstract] A test stand has been design and built by the authors for testing of ultrasonic piezoelectric transducers whose nominal operating frequencies range from 0.6 to 10 MHz. Excitation of a tested transducer into the radiating mode comes from a radio pulse generator with an amplifier and a modulator or from a video-pulse defectoscope generator. The transducer, together with an array of reflectors or auxiliary transducers, is immersed in water. Its radiation pattern is plotted with the aid of a polar coordinator mechanism driven by a synchronous motor, the signal amplitude as a function of its distance from a reflector is measured with the aid of a potentiometer driven by a linear motor, and the spectra of probing and echo signals are recorded with an analyzer and an oscillograph. At each test frequency are measured the ratios of echo voltage to probing voltage which correspond, respectively, to the voltage sensitivity and the current sensitivity of the device. Measured can also be the amplitude-frequency characteristic of a transducer, namely its sensitivity as a function of the signal frequency within a radio pulse. The overall inaccuracy of the test stand is approximately 20%, owing mainly to errors introduced by the oscillograph and the polar coordinator mechanism. Transducers of DUK-66 defectoscopes were checked in this test stand and found to perform below specifications. Resonance in the amplifier channel of these defectoscopes at the nominal transducer frequency was found to be the cause of mismatch and the resulting deficiency. Figures 3; references: 5 Russian.
[290-2415]

UDC 531.787.6.087.92:621.317.39

A SILICON INTEGRATED-CIRCUIT PRESSURE TRANSDUCER WITH TRIMMING RESISTORS ON THE CHIP

Moscow IZMERITEL'NAYA TEKHNIKA in Russian No 5, May 80 pp 28-30

VAGANOV, V. I., BEKLEMISHEV, V. V., GONCHAROVA, N. I. and MOSKIN, A. B.

[Abstract] An integrated-circuit pressure transducer has been built on an *n*-type silicon chip with a (100) crystallographic orientation and includes a bank of trimming resistors in addition to the tensoresistors in the bridge circuit. This provides a more accurate initial bridge balancing, to which the variance between resistors of the same type connected into different bridge arms contributes. Interconnections are made with strongly doped p^+-type silicon rather than conventionally by metallization, which eliminates stress concentrations as well as the possibility of shorts and also extends the performance range of the elastic element. The null drift due to temperature changes is (0.07-0.1)%/K over the 20-50°C range. The transducer has been designed for the $0-3.3\cdot10^4$ Pa pressure range, with a sensitivity of $(1-5)\cdot10^{-4}$ mV/(V·Pa), a basic error within 1%, and an output resistance of 600-2000 ohms. The size of the 10 μm thick diaphragm is 1.5x1.5 mm^2 and the size of the originally 300 μm thick octogonal chip is 3.5x3.5 mm^2. Figures 1; references 11: 4 Russian, 7 Western.
[290-2415]

UDC 534.6.08:53.087.92

EVALUATION OF THE METROLOGICAL CHARACTERISTICS OF AN AXIALLY POLARIZED PIEZOELECTRIC TRANSDUCER

Moscow IZMERITEL'NAYA TEKHNIKA in Russian No 5, May 80 pp 72-74

BRAILOV, E. S., VASSERGISER, M. Ye., GURALLO, O. N., SAVENKOV, N. B. and TIMOSHENKO, V. S.

[Abstract] The performance of a piezoelectric transducer as a measuring instrument is evaluated on the basis of its equivalent circuit. Such a transducer consists essentially of a bushing pressed into a piezoceramic cylinder which carries an active mass. Calculations are shown for an axially polarized piezoceramic cylinder with the electrodes deposited on its lateral surface. The equivalent circuit for radially symmetric and axially uniform harmonic vibrations is designed to cover the entire wide frequency range from the quasi-static mode to the first resonance. The

performance characteristics are obtained by solving the fundamental equation of motion with the appropriate boundary conditions on the mechanical side and the current-voltage relation on the electrical side. Estimates of the conversion function and the influence factors, including effects of aging and temperature variations, indicate that it is sufficient to check the performance of such a transducer at only two points within the operating frequency range. Figures 3; references: 4 Western (3 in translation).
[290-2415]

UDC 539.231:621.793.73

A VACUUM APPARATUS FOR PRODUCING TELLURIUM THIN-FILM PHOTOELECTRIC CONVERTERS

Moscow IZMERITEL'NAYA TEKHNIKA in Russian No 5, May 80 pp 25-27

TESLENKO, A. I.

[Abstract] A laboratory vacuum apparatus has been built for producing thin tellurium films with the optimum optical and photoelectric parameters. It includes a continuous composite inspection of the film properties and the condensation process. The equipment consists essentially of a chamber with polyphenyl ether as the working fluid to ensure a $(5-6)\cdot10^{-6}$ Pa vacuum within an approximately 0.1 m^3 large volume. Tellurium is evaporated from molybdenum effusors. The evaporation rate prior to deposition is controlled by means of two shields, one covering the effusors and one covering the substrates. Substrates (plates of KCl single crystals) are cleaned by ion purification with special electrodes. The inspection system includes an LG-25 CO_2 laser for 0.1-2 μm thick films of an He-Ne laser for thinner films which generate probing radiation, a disk shutter which forms a probing beam, a reference photoelectric converter with an amplifier and a detector, a waveguide, a quartz-type deposition rate and thickness transducer, an electronic resistance transducer, a transmitted-radiation probe, a resistance gauge connected to a digital ohmmeter, and a quartz-type thickness gauge. Taking into account systematic errors, which depend on the range of film thickness, film characteristics as functions of the processing time in this apparatus have been determined for a typical evaporation rate of 0.75 nm/s at temperatures from 306 to 373 K. Figures 2; references: 2 Russian.
[290-2415]

UDC 621.315.592

CONVERTER-AMPLIFIER BASED ON DIODE WITH ELECTRON MIGRATION

Moscow RADIOTEKHNIKA in Russian Vol 35, No 6, Jun 80 pp 40-42 manuscript received after completion 5 Sep 79

YATSUNENKO, A. G. and SOKOLOVSKAYA, I. I.

[Abstract] Experiments are done on the conversion characteristics of an upconverter based on a Gunn diode operating in the suppressed-domain mode and connected simultaneously in two tank circuits: a waveguide tee in the 3-cm band with two shorting pistons, and a low-Q signal tank circuit formed by the inductance and inter-turn capacitance of a coil with special provisions for tuning. The spectrum of the output signal, and the relation between the powers of the input, "pumping" and output signals showed that frequency conversion is parametric. The output signal is a superposition of the Gunn-effect frequency and the input signal frequency. Thus the output frequency can be controlled by changing the input frequency, which should enable use of the proposed circuit as a variable frequency oscillator. In the experiments, the central frequency of 170 MHz was tunable over a range of ±5%. The authors thank S. A. Kostylev for valuable advice. Figures 2; references 6: 2 Russian, 4 Western.
[296-6610]

CRYOGENICS AND SUPERCONDUCTIVITY

UDC 537.312.62:621.3.029.6

RECEIVERS FOR THE MILLIMETER BAND BASED ON THE JOSEPHSON EFFECT (A SURVEY)

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 24, No 6, Jun 80 pp 1121-1142 manuscript received 3 Aug 79

LIKHAREV, K. K. and MIGULIN, V. V.

[Abstract] The article reviews the latest advances in research and development of microwave receivers based on Josephson contacts. The distinguishing features of Josephson contacts as nonlinear elements are noted, and the following classification is proposed for reception devices using such contacts: 1) Mixers (down-converters); 2) Parametric amplifiers without frequency conversion; and 3) Quadratic video detectors. Specific microwave devices in each of these categories are considered. The working principles of each device are described along with their particular advantages and disadvantages, experimental results, and also the results of calculations of attainable limiting characteristics with predictions for the near future. It is shown that receivers based on Josephson contacts are more sensitive than those based on other physical principles throughout practically the entire millimeter band, whereas in the nearby centimeter and submillimeter bands, cryogenic devices based on other semiconductive and superconductive components have better characteristics. Optimum multiple-contact systems made by methods of integrated electronics could be used to improve the characteristics of Josephson-effect microwave receivers. The authors thank V. P. Zavaleyev, L. S. Kuz'min, V. N. Radzikhovskiy, I. A. Strukov, V. S. Etkin and V. B. Shteynshleyger for discussing the article. Figures 11; tables 3; references 67: 18 Russian, 49 Western.
[292-6610]

ELECTRICAL ENGINEERING EQUIPMENT AND MACHINERY: APPLICATIONS AND THEORY

UDC 62-835.001.24

THYRISTORIZED ELECTRICAL D.C. DRIVES WITH AN ELASTIC MEMBER ON THE MECHANICAL SIDE

Moscow ELEKTROTEKHNIKA in Russian No 6, Jun 80 pp 16-19 manuscript received 20 Nov 79

IVANOV, G. M., candidate of technical sciences

[Abstract] Several schemes for an electrical drive system with speed regulation are analyzed by the method of transfer functions and Bode diagrams. The motors are energized through a thyristor bank and have long shaft extensions for elastic coupling to load mechanisms in various stages of a technological process line. The object is stabilization of the angular velocity and damping of torsional vibrations. A current regulator is included, but counter-emf feedback is disregarded. One scheme includes only a control circuit for the angular velocity of the load based on an amplitude-frequency characteristic of the second kind. One scheme includes only a control circuit for the angular velocity of the motor based on an amplitude-frequency characteristic of the first kind. One scheme includes both control circuits. The results of a comparative analysis reveal that, as the number of circuits is increased, the relative damping coefficient decreases and it becomes more difficult to damp vibrations by introducing negative feedback of the elastic torque or of its derivative alone. The performance of the first scheme (two control circuits) and of the second scheme (load control circuit only) with negative torque feedback is also evaluated. With only one control circuit to be used, the tachomotor generator for speed control should be mounted on the load shaft, if possible, otherwise on the motor shaft. In the latter case the current regulator can be of the proportional-integral type. Figures 2; tables 1; references: 3 Russian.
[294-2415]

UDC 621.311.6:621.316.722.1:621.376.5

A STABILIZED POWER SUPPLY WITH INTEGRAL PULSE-DURATION MODULATION

Moscow ELEKTROTEKHNIKA in Russian No 6, Jun 80 pp 33-35 manuscript received 7 Jan 80

GLADYSHEV, S. [illegible]., candidate of technical sciences and CHUGAYEV, V. V., engineer

[Abstract] Pulse-duration modulation with integration of the error signal is the simplest as well as most reliable and efficient method of stabilizing the voltage of a power supply. Here the dynamic characteristics of such a stabilizer are analyzed by linearization of the difference equation describing a discrete system. The closed-loop regulator includes a first-order linear component, and accordingly, its transfer ratio is assumed to be equal to unity and any deviation from this value is in reality accounted for by a corresponding change in the threshold level. The free motion of the closed system with a constant reference signal and without saturation is considered on this basis. The stabilization factor and the transient time are calculated as functions of the open-loop gain, as well as the optimum gain with respect to minimum transient time and the limiting gain corresponding to no stabilization are established. Figures 3; references: 7 Russian.
[294-2415]

UDC 621.313.13

ANALYZING THE DYNAMICS OF A 2-MASS ELECTRIC DRIVE SYSTEM WITH THE ROOTS OF ITS CHARACTERISTIC EQUATION

Novocherkassk IZV. VUZ: ELEKTROMEKHANIKA in Russian No 5, May 80 pp 519-521

SHAFRANSKIY, V. I., candidate of technical sciences, dotsent, Belorussian Polytechnical Institute; and BOROVOY, B. V., candidate of technical sciences, dotsent, Belorussian Polytechnical Institute

[Abstract] The transient process in a 2-mass electric drive with elastic coupling, a stable and simple system, is describable by a third-order differential equation. The roots of its characteristic equation can be calculated exactly by the Cardan method or approximately by the Lin method, one real root and two complex roots. A system dynamics analysis based on

the evaluation of these roots yields the parameters of both the aperiodic and the oscillatory components of the transient process, also the dependence of the dynamic behavior of the system on the moment of inertia. Tables 1; references: 4 Russian.
[303-2415]

UDC 621.316.542.064.42.001.5

CURRENT INTERRUPTION WITH AN EXPLOSIVE-TYPE ARC QUENCHING DEVICE

Moscow ELEKTROTEKHNIKA in Russian No 6, Jun 80 pp 35-37 manuscript received 1 Jun 78

KOROL'KOV, V. L., candidate of technical sciences and DATSENKO, V. A., candidate of technical sciences

[Abstract] Processes in an explosive-type arc quenching circuit breaker and action of the ambient medium on the arc during current interruption were examined in an experiment with ultrahigh-speed photorecording. The apparatus included a generator of periodic pulse current, and RLC power circuit, an intensifier lamp with an LC circuit, a timer, and a detonation generator. In the experiment the evolution of vapor-gas cavities in the arc and the pressure variation in it with time were recorded, including pressure jumps. Both successful and unsuccessful current interruptions were tested as well as interruptions without an explosive charge and an explosion without an arc. An evaluation of the results indicates that explosion in such a circuit breaker is analogous to deep-water explosion. The cavities filled with products of explosion and material of the arc remain in existence throughout the current interruption period. Arc quenching is effected by intensive heat dissipation under the high pressure produced by the explosion. As the explosion products penetrate the arc cavity, they increase its electrical conductivity. By improving the conditions for this penetration, especially during the final stage of current interruption, it should be possible to control the breaker performance. Figures 4; references 6: 3 Russian, 3 Western.
[294-2415]

UDC 621.316.925.42

IMPROVEMENT OF THE MINIMUM-VOLTAGE RELAY STARTING ELEMENT

Moscow ELEKTRICHESKIYE STANTSII in Russian No 6, Jun 80 pp 72-74

BORODENKO, V. A., engineer

[Abstract] Deficiencies of the conventional starting element in EV-235 electromechanical relays with armature drop-out used for automatic reserve switching include a high uncontrolled drop-out voltage, which makes it difficult to ensure the required voltage setting, and a reduction of the response speed due to slow decay of the residual emf. The feasibility of overcoming these problems with the aid of capacitors has been examined, one capacitor forming a series ferroresonant circuit with the relay coil when the magnetic circuit is closed and one capacitor forming together the other and with the relay coil a ferroresonant circuit when the magnetic circuit is open. With this arrangement the drop-out voltage increases with decreasing line frequency and periodic switching of the relay because of the drop-out voltage becoming higher than the pull-in voltage is eliminated. The effectiveness of this device has been verified experimentally in the case of a coasting synchronous motor. An added feature is automatic selection of the relay tripping time depending on the kind of load. Existing relays can be easily modified accordingly in the plant maintenance shop. Figures 4; references: 5 Russian.
[299-2415]

ELECTROMAGNETIC WAVE PROPAGATION, ELECTRODYNAMICS

UDC 535.3

METHODS FOR THE CALCULATION OF FOCUSING MEDIA WITH A VARIABLE INDEX OF REFRACTION (REVIEW)

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 25, No 5, May 80 pp 897-911 manuscript received 13 Jul 79

MIKAYELYAN, A. L.

[Abstract] Methods are discussed for calculation of the focusing of strain-heterogeneous media with central symmetry, and cylindrical media with axial symmetry. Development of such methods is important not only during creation of devices and elements, it will likely also contribute to broadening of the range of applications of heterogeneous media. The review consists of two parts. In the first part cases of the simplest focusing heterogeneous media are considered, in which the index of refraction varies along but one coordinate. The second part is concerned with a discussion of methods of calculation of heterogeneous media with a more complex distribution of the index of refraction, dependent on two or three coordinates. The author is grateful to Ya. N. Fel'd for helpful discussions during reading of the manuscript. Figures 9; references 12: 8 Russian, 4 Western.
[284-6415]

UDC 621.371.519.2

ON THE INTENSITY FLUCTUATIONS OF THE RADIATION BEHIND A LENS

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 25, No 5, May 80 pp 957-963 manuscript received 3 Apr 78

BELOV, M. L. and ORLOV, V. M.

[Abstract] Fluctuations of the intensity of radiation caused by turbulence of the atmosphere, at the focal point of a lens with arbitrary phase and amplitude fluctuations in the wave incident to the lens, were studied in a 1964 work by N. G. Denison and Yu. A. Ryzhev. The present paper investigates the fluctuations of intensity at an arbitrary point behind a lens. It is shown that the correlation function of the fluctuations of intensity is equal to the square of the coherence function, and the dispersion of the intensity of fluctuations is the square of the average intensity in the image. During this the comparative fluctuations of intensity are equal to unity irrespective of the point of observation behind a lens. In the paraxial approximation considered, the problem concerned with locating the statistical moments of intensity behind a lens is reduced to a simpler problem--determination of the second moments of the field behind a lens. Figures 2; references: 4 Russian.
[284-6415]

UDC 621.372.86

USING THE FIELD THEORY METHOD TO CALCULATE A MEANDER-LINE DECELERATING SYSTEM IN A SHIELD

Moscow RADIOTEKHNIKA in Russian Vol 35, No 6, Jun 80 pp 82-85 manuscript received 6 Jul 79

LOSHAKOV, L. N., IVANOVA, I. Ye. and DZUGAYEV, V. K.

[Abstract] A report delivered in May 1979 at the Thirty-Fourth All-Union Science Session of the Scientific and Technical Society of Radio Engineering, Electronics and Communications imeni A. S. Popov, Dedicated to Radio Day. In an earlier paper the authors had shown the feasibility of analyzing the dispersion properties of a meander-line decelerating system based on solving electromagnetic field equations in an elliptical cylindrical coordinate system. This report extends the earlier results by considering the influence of a metal shield surrounding the meander line. The dispersion curves show a slight anomaly in the long-wave region. The shield has [illegible] effect on deceleration and dispersion properties of the [illegible] at high values of the parameter $\lambda/2a\sqrt{\epsilon\mu}$, where λ is the wave-length of the exciting field, a is half the length of the transverse [illegible] in the [illegible] line, ε and μ are the dielectric constant and relative [illegible] of the medium. Figures 1; references: 2 Russian.

UDC 621.391.81[illegible]

[illegible] CRITICAL ABSORPTION OF RADIO WAVES IN THE [illegible] OF THE MICROWAVE RANGE

[illegible] RADIOTEKHNIKA in Russian Vol 23, No 7, Nov 80 pp 119-[illegible] Sep 78

[illegible], H. H.

[illegible] statistical meteorological material [illegible] with respect to an evaluation of the practical [illegible]

[illegible]

[illegible] the respective absorption coefficients in [illegible]

[illegible] of absorption in the transparency windows [illegible] with waves [illegible] The possibility is considered of [illegible] of optimum [illegible] statistical [illegible] coefficients with [illegible] of the same wavelengths. A comparison is made [illegible] with use of the statistical high-level [illegible] in accordance with the [illegible] characterized by the varying [illegible] the varying effectiveness of the [illegible] statistical calculations of absorption [illegible] results of aerological sounding of the [illegible] January, [illegible]. The following conclusions [illegible] the precision of calculations of the vertical [illegible] of the millimeter equivalent length [illegible] of the [illegible] critical absorption of radio waves [illegible]

statistically high extrapolations of the absorption coefficients are preferable (more precise) as compared with calculations using the seasonal EDP of radio waves in the transparency windows of the earth's atmosphere at wavelengths $\lambda \geqslant 0.8$ cm in the summer period of the year and with $\lambda \geqslant 0.33$ cm in winter; 2) In the transparency windows of the atmosphere $\lambda = 0.15$ cm and 0.33 cm for the summer period of the year and at a wavelength $\lambda = 0.15$ for winter; and 3) Calculations of τ with the use of EDP and with statistically high extrapolation of the absorption coefficient gave close results. The authors are grateful to V. S. Troitskiy and S. A. Zhevakin for discussion of the results and V. I. Drobyshevich for assistance exerted in conducting calculations of the "BESM-6" computer. Figures 1; tables 3; references 26: 24 Russian, 2 Western.
[284-6415]

ELECTRON AND ION DEVICES; EMISSION;
GAS-DISCHARGE AND ELECTRON-BEAM DEVICES

UDC 537.533.32

TWO-SPIRAL QUADRIPOLE FOCUSING SYSTEM FOR RELATIVISTIC ELECTRON BEAM

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 25, No 5, May 80 pp 1072-1078 manuscript received 9 Apr 79

DUBAS, L. G.

[Abstract] A new form is proposed for a system of two-spiral quadripole focusing of a heavy-current relativistic electron beam. The advantages are shown of such a system over the single-spiral systems of quadripole periodic focusing of an electron beam with static magnetic fields which are described in translations of two U.S. patents (1966 and 1975). The principal parameters of the proposed two-spiral system are: energy of electrons, 1 Mev; current of electron beam, 1 kA; maximum diameter of beam, 29 mm; minimum diameter of beam, 14 mm; current through each of the conductors of the focusing system, 3.5 kA. Focusing takes place independently in each of two mutually perpendicular directions in the plane of the cross section of the beam. Identification of the characteristics of the focusing system boils down to a solution of one differential equation for the amplitude of the natural oscillations with periodic boundary conditions. A numerical calculation of the equation obtained after reduction of all parameters to a dimensionless magnitude gives the dependence of an advance of phase for the frequency oscillations and the average focusing force as a function of two parameters proportional to the forces which are created by the focusing system and the space charge of the beam. Figures 4; references 3: 1 Russian, 2 Western in translation.
[284-6415]

UDC 621.391.822:621.385.6

ON THE ONE-DIMENSIONAL AND ONE-SPEED THEORY OF NOISE IN AN ELECTRON BEAM

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 25, No 5, May 80 pp 1058-1062 manuscript received 29 May 78

GOLUBENTSEV, A. F. and DAVIDOVICH, M. N.

[Abstract] Four systems of equations are presented, which make it possible to analyze noise processes with the use of different variables. With the aid of a selection of these variables, an analysis is made of propagation fluctuations along an electron beam. It is shown that the use of different variables does not introduce any changes into the one-dimensional one-speed theory of noise of House-Robinson. The results obtained for different variables agree among themselves. This confirms the fact that the four systems do not contain internal contradictions and, with the assumptions made, truly describe noise processes in an electron beam. Tables 1; references: 3 Russian.
[284-6415]

ELECTRON TUBES: ELECTROVACUUM TECHNOLOGY

UDC 621.316.761.2.016.25:621.385.832

A STATIC COMPENSATOR OF REACTIVE POWER BUILT WITH ELECTRON-BEAM RECTIFIER TUBES

Moscow ELEKTROTEKHNIKA in Russian No 6, Jun 80 pp 9-12 manuscript received 30 Aug 79

LIPATOV, V. S., candidate of technical sciences, KHOMSKIY, I. G., candidate of technical sciences, ZELENOV, V. Ye., candidate of technical sciences, ALEKSANDROVA, L. P., engineer, ALEKSYUTKIN, G. I., engineer, VERKHOVSKYAYA, Ye. E., engineer, RASSADINA, N. A., engineer, and TROITSKAYA, G. L., engineer

[Abstract] Following the latest trend toward rectifier-type sources of reactive power with fast and smooth regulation, as a means of voltage stabilization under highly variable and impact loads, a static compensator (source) of reactive power has been developed with electron-beam rectifier tubes instead of thyristors and, therefore, not requiring forced commutation. It includes an overvoltage limiting rectifier bridge in parallel with an auxiliary conventional inverter bridge, shunted by a capacitor and also by an energy storing inductance. For continuous operation the inverter, consisting of thyristors with only partial control, requires a matching transformer or autotransformer and a smoothing reactor. For pulse operation the inverter, consisting now of electron tube rectifiers with full control, does not require the matching transformer and the smoothing reactor. Protection in the case of short circuit on the load side is provided by an arrangement for advancing the control angle by 120°. Protection in the case of rectifier cut-off is provided by an appropriate feedback circuit with voltage sensors and an OR logic for ensuring forced commutation. Circuit diagrams and performance calculations, as well as typical current and voltage oscillograms, are shown here. Figures 5; references: 5 Russian.
[294-2415]

UDC [621.385.8:537.533].001.1

PROSPECTIVE APPLICATIONS FOR ELECTRON-BEAM RECTIFIER TUBES

Moscow ELEKTROTEKHNIKA in Russian No 6, Jun 80 pp 7-9 manuscript received 30 Aug 79

PEREVODCHIKOV, V. I., doctor of technical sciences, ZELENOV, V. Ye., candidate of technical sciences, LIPATOV, V. S., candidate of technical sciences, and KHOMSKIY, I. G., candidate of technical sciences

[Abstract] Electron-beam rectifier tubes operating as switches, characterized by high speed and full controllability, provide the solution to the problem of protecting high-voltage vacuum-tube devices in equipment such as microwave oscillators and electron guns or other particle injectors. An outstanding feature is that they do not require special equalizers for paralleling of individual rectifiers or rectifier bridges. They can also be used in inductive energy storing devices, where the load and the electron-beam switch are shunted by a "slow" low-resistance switch. Similarly, with a shunting capacitor, they can be used for d.c.-to-a.c. conversion, including conversion to a higher than commercial frequency (400-1000 Hz). Another possible application for electron-beam rectifier tubes is in capacitive compensators of reactive power, up to 50 MVA. At the All-Union Institute of Electrical Engineering imeni V. I. Lenin there have been developed 2-5 μs fast electron-beam switches for 500 kW electron-beam smelting furnaces, as well as for 5 A - 40 kV and 50 A - 150 kV particle injectors. Switches for the maximum feasible voltage of 250 kV and 100 A (continuous duty) or 1000 A (pulse duty) are now being developed. The life expectancy of all these devices is of the order of 30,000 h in operation. Their techno-economic indicators compare favorably with those of other devices for similar applications, especially in the high-voltage high-power range. Figures 4; references 9: 8 Russian, 1 Western.
[294-2415]

UDC [621.385:8.537.533].001.3

ELECTRON-BEAM RECTIFIER TUBES

Moscow ELEKTROTEKHNIKA in Russian No 6, Jun 80 pp 5-7 manuscript received 30 Aug 79

PEREVODCHIKOV, V. I., doctor of technical sciences

[Abstract] Developments in electron power tubes and in methods of forming high-intensity electron beams have been utilized in the design of high-power high-voltage electronic switching devices. The advantages of conventional high-vacuum tubes over gas tubes and semiconductors for this application include, in addition to the high voltage rating made possible by their high electrical strength, full controllability of the current and that they do not require special equalizers for paralleling of individual rectifiers or rectifier bridges. A major drawback here is the low efficiency, caused by the presence of a space charge. This problem can be overcome by retarding the electrons at the anode. For this purpose, an accelerating electrode is placed near the cathode and a sufficiently high positive potential applied to it, higher than the anode potential during conduction. The performance of such a device operating as a half-wave rectifier is described here, with reference to a simple equivalent circuit and an expression for the efficiency. At the All-Union Institute of Electrical Engineering imeni V. I. Lenin there are now being developed three models of such a device with the respective ratings: 1) 2 A - 150 kV; 2) 20 A - 70 kV; and 3) 100 A - 150 kV. The anodes are water-cooled in all of them. The accelerating electrode is also water-cooled, except in the low-current (2 A) model. Their current-voltage characteristics are shown and basic technical design data given. Their two main areas of application are high-speed selective protection of costly equipment under short circuit and controlled a.c.-d.c.-a.c. conversion with phase regulation as well as compensation of the reactive power. Figures 3; tables 1; references: 2 Russian.
[294-2415]

UDC 621.371(290)

AEROSOL ATTENUATION OF INFRARED RADIATION OF THE MARINE ATMOSPHERE

Moscow RADIOTEKHNIKA in Russian Vol 35, No 6, Jun 80 pp 79-82 manuscript received 16 Nov 79

KONOVALOV, G. K. and KNYAZEV, L. V.

[Abstract] This article gives the results of calculation of aerosol attenuation of infrared radiation propagating in the layer of atmosphere above the sea with consideration of variation in the complex index of refraction, the material of the aerosol particles and spectral components as weather conditions change. The analysis is based on the assumption of polydispersed spherical particles in the plane-wave approximation with one-time scattering of radiation and particles of the same average density. The component caused by the surface of the sea is accounted for by wind interaction and condensation, forming droplets with some salt concentration. Curves are given showing IR attenuation as a function of humidity and as a function of range of visibility and wind speed. A table is given showing the aerosol attenuation of infrared radiation above the sea for different wind speeds, ranges of visibility and humidities. Figures 2; tables 1; references 15: 8 Russia, 7 Western (2 in translation).
[296-6610]

INSTRUMENTS, MEASURING DEVICES AND TESTERS, METHODS OF MEASURING, GENERAL EXPERIMENTAL TECHNIQUES

UDC 536.52:681.2

AGGREGATE COMPLEX OF STATIONARY PYROMETRIC CONVERTERS AND RADIATION PYROMETERS APIR-S

Moscow PRIBORY I SISTEMY UPRAVLENIYA in Russian No 5, 1980 pp 13-17

LAKH, V. I., candidate of technical sciences, and SAMCHENKO, G. P.

[Abstract] Work conducted in recent years at the L'vov Scientific Industrial Association "Termopribor" [Thermal Instrument] made it possible to create an aggregate complex of stationary pyrometric converters and pyrometers (APIR-S). The APIR-S complex consists of a series of primary pyrometric converters, secondary measuring-transducers, and auxiliary devices necessary for their operation, united in the standardized parametric series of pyrometric converters of the State System of Industrial Instruments and Means of Automation (GSP). The basic principle of construction of the APIR-S complex is the creation of pyrometers of various classes (of full and partial radiation, and of the spectral ratio) on a single constructional base. A block diagram shows the structure of the APIR-S complex and its connection with other aggregates of the GSP. The principal technical characteristics of the pyrometric converters and pyrometers are shown in four tables. Series production of the means of the APIR-S complex has been assimilated by the Kamenets-Podol'skiy Instrument Making Plant. Figures 1; tables 4; references: 2 Russian.
[278-6415]

UDC 536.521

NEW SPECTRAL-RATIO PYROMETERS

Moscow PRIBORY I SISTEMY UPRAVLENIYA in Russian No 5, 1980 pp 17-19

YEGOROV, D. Ye., SYRTSOV, S. P., engineers; TRUBITSIN, Ye. V., candidate of technical sciences

[Abstract] Recently the Scientific Industrial Association "Lenteplopribor [Leningrad Thermal Instruments] developed and mastered series production of a complex of "Spektropir" type automatic spectral-ratio pyrometers. The complex includes pyrometers of four types which differ in their function, principles of operation, and basic technological characteristics. At the same time, a number of common features are inherent in them, which unite these pyrometers into a single pyrometric complex. In particular, they all operate in the near infrared region of the spectrum, using silicon photoconverters and photodiodes based on silicon and germanium for conversion of light fluxes into electrical signals. The transducers of all the pyrometers are constructed according to the two-channel principle (with two radiation detectors) which makes it possible to realize a simpler and more reliable construction. Their electronic devices are made with semiconductor devices and integrated circuits. Pyrometers, into the composition of which recording and indicating devices enter, have a scale with numerical markings in degrees Celsius, during which the nature of the scales is very close to linear in the majority of the modifications of the pyrometers. The principal technical characteristics of the "Spektropir" type are shown in a table. Block diagrams are presented for the "Spektropir-7" and "Spektropir-8." Figures 3; tables 1; references: 2 Russian.
[278-6415]

UDC 536.532

DIGITAL DEVICE FOR DETERMINING TEMPERATURE OF MOLTEN METAL

Moscow PRIBORY I SISTEMY UPRAVLENIYA in Russian No 5, 1980 pp 19-20

ZUYEV, V. M., FAYNZIL'BERG, L. S., SHIYANOV, B. Ye., engineers; and
ZHITETSKIY, L. S., candidate of technical sciences

[Abstract] The Cybernetics Institute, UkrSSR Academy of Sciences (Kiev) developed, and together with VNIIAchermod [All-Union Scientific-Research Institute for Automation of Ferrous Metallurgy] (Moscow), tested under production conditions at the Novolipetskiy Metallurgical Plant, the digital device "Gradus" [Degree] intended for operation in a complex with thermoelectric thermometers with interchangeable units, in particular with the TTSB, TPR-2075, TVR-7175 and other thermometers. The device makes it possible to determine automatically the steady-state value of the signal of a thermocouple, immersed for a short time in metal and to present the results of measurement in digital form. A description of the device and its technical characteristics are presented. Figures 1; references: 2 Russian.
[278-6415]

UDC 62-505:512.26

CONCERNING OPTIMUM DISTRIBUTION OF TOLERANCES FOR TECHNOLOGICAL SCATTER OF THE PARAMETERS OF MODULES IN A MEASUREMENT SYSTEM

Moscow IZVESTIYA AKADEMII NAUK SSSR: TEKHNICHESKAYA KIBERNETIKA in Russian No 3, May/Jun 80 p 217

FOMENKO, V. N. and ROZOVSKAYA, N. A., Leningrad

[Summary of article deposited in the All-Union Institute of Scientific and Technical Information, No 3710-79, 25 Oct 79]

[Abstract] The authors consider the problem of finding the distribution of tolerances for technological scatter of the parameters of the individual modules of a measurement system with a criterion of cost limitation for making the system while optimizing the metrological properties. The precision of the system is characterized by the functional $\gamma = D\delta/(E-\bar{\delta})^2$, where $D\delta$ and $\bar{\delta}$ are the variance and mathematical expectation of the random error at the output of the system. For K modules in the system, the functional Ψ is minimized by finding the two-dimensional surface in the space of 4K variables that contains the sought extremal point.
[287-6610]

UDC 621.317.75

MULTIRANGE RECORDING CHANNEL OF LIGHT-BEAM OSCILLOGRAPH

Moscow PRIBORY I SISTEMY UPRAVLENIYA in Russian No 5, 1980 pp 30-31

FROYMOVICH, B. N. and KLYKOVA, L. K.

[Abstract] The Production Association "Vibropribor" [Vibration Instruments] (Kishinev) produces the selectors of the recording limit, R009 and R010, and the channel calibrator P029, which accelerate the process of calibration of an oscillographic galvanometer and expands the recording limit of the signal. These devices, together with the oscillographic galvanometer, form a recording channel for a light-beam oscillograph.

Data on the R009, R010 and the channel calibrator P029 are given in a table. Use of the selectors R009, R010 and the channel calibrator P029 in a complex with a light-beam oscillograph considerably facilitates the process of adjustment of the recording channel and of interpreting oscillograms in the operating process. Figures 2; tables 1; references: 2 Russian. [278-6415]

UDC 621.317.773

N044 LIGHT-BEAM OSCILLOGRAPH

Moscow PRIBORY I SISTEMY UPRAVLENIYA in Russian No 5, 1980 pp 29-30

POL'SKIY, E. M., candidate of technical sciences; and TIKHONYAK, V. A.

[Abstract] The Production Association "Vibropribor" [Vibration Instruments] (Kishinev) developed two modifications of the N044 light-beam oscillograph in which, together with the traditional recording on a photographic carrier with chemical development, recording on an ultraviolet sensitized carrier with direct density is used. The merit of the latter method of recording lies in the visualability and efficiency of management of the information received. Data on the volume and mass of several types of oscillographs are presented in a table. The N115 and N117 oscillographs assure a wider range of speeds of movement of the carrier and a significantly larger recording rate because of the use of the DRSh100-2 mercury lamp. The built in time marker of the N044 oscillograph is unified with the time marker of the N043 and is implemented by series 155 microcircuits. The technical characteristics of the galvanometers which enter into the complex of N044

oscillographs are presented in a table. A photograph and the principal technical characteristics of the N044 oscillograph are given. Figures 1; tables 2; references: 1 Russian.
[278-6415]

UDC 669-278:658.562

A NEW METHOD OF CHECKING THE PROFILE OF MEMBRANES AND OF A CRIMPING TOOL

Moscow IZMERITEL'NAYA TEKHNIKA in Russian No 5, May 80 pp 23-24

SOKOLOV, V. P. and LIMARENKO, A. A.

[Abstract] A new method of checking the profile of crimping tools has been developed which is much more accurate than using counterproofs cast of a fusible alloy. Blank 0.5-1 mm thick plates of carbon steel are machined by optical precision grinding with a pantograph to a 50:1 scale, to produce an exactly inverse profile with the maximum deviation not exceeding 5 μm. A crimping die is then cut following such a template and its accuracy is checked with a set of 0.05 ... 0.1 ... wire gauges held in copper sleeves. This method is 40% more accurate than using cast counterproofs and 2-2.5 times more accurate than using x-y plotters. It is 3-10 times more labor efficient and suitable for checking out instrument membranes 10-150 mm in diameter. References: 1 Russian.
[290-2415]

UDC 681.3.087.92:621.3.089.6

A METHOD OF MUTUALLY COMPENSATING THE ERRORS OF ANGLE TRANSDUCERS

Moscow IZMERITEL'NAYA TEKHNIKA in Russian No 5, May 80 pp 24-25

PETROV, V. P. and KARAKULEV, Yu. A.

[Abstract] The accuracy of a photoelectric angle transducer depends on several factors, including errors in the relative position of its elements. In practice these errors are reduced by adjustment. One method is based on an experimental determination of the optimum relation between readout and alignment errors during adjustment of the two readout devices nominally 180° apart. Accordingly, the ratio of signal amplitudes and the difference

between signal durations have been determined. Considering the impossibility of changing the duration of either signal so as to eliminate the 20% difference between the durations of both, a ratio of signal amplitudes about 1.5 rather than equal to 1.0 is found to result in the optimum compensation of said errors. Figures 3; references: 5 Russian.
[290-2415]

MICROELECTRONICS

K174KhA2 AND K174UR3 MICROCIRCUITS

Moscow RADIO in Russian No 4, 1980 pp 59-60

ALEKSANDROV, G.

[Abstract] The K174KhA2 microcircuit is designed for use in class I-III superheterodyne AM receivers. The device contains r-f amplifier, double balanced mixer with separate heterodyne and i-f amplifier with AGC. Supply voltage is no more than 9 V, current consumption is 5-13 mA, sensitivity is no more than 20 μV at a signal-to-noise ratio of 20 dB on a frequency of 1060 kHz, and output voltage is 60 mV. The K174UR3 microcircuit is designed for use in superhet FM broadcast receivers. The device contains a limiter-amplifier, frequency detector and a-f preamplifier. Supply voltage is 6 V, current consumption is no more than 12 mA, a-f output voltage is no more than 100 mV, coefficient of AM suppression is at least 40 dB for input signal of 500 μV at 10.7 MHz and deviation of 50 kHz. Schematic circuits and structural diagrams are given. Figures 4.
[291-6610]

OPTOELECTRONICS, QUASI-OPTICAL DEVICES

UDC 535.8:621.3.038

NEW TYPES OF OPTOELECTRONIC DEVICES

Moscow PRIBORY I SISTEMY UPRAVLENIYA in Russian No 5, 1980 pp 22, 27

NOSOV, Yu. R., doctor of technical sciences

[Abstract] USSR production has developed and mastered in production a number of new optoelectronic devices of the optron [optoelectronic storage element] type with improved characteristics. Three of these devices are discussed: 1) The Type AOD-120 unencapsulated fast-acting diode optron is intended for galvanic decoupling in digital microelectronic devices produced on the basis of hybrid microcircuits and micro-assemblies; 2) The Type K249KN1 microcircuit is an optoelectronic commutation switch for analog signals; and 3) The AOD111A is an optron with an open optical channel of the reflecting type. This optron is suitable for monitoring the quality of reflection surfaces, noncontact measurement of the speed of a rotating shaft, operating as a pulse transducer, and information readout. The parameters of the first two devices are presented in table form. The optoelectronic devices will prove to be useful in instrument building and computing techniques. Figures 5.
[278-6415]

UDC 535.31:517.2

CONCERNING ONE GENERALIZATION OF THE GEOMETRICAL OPTICS METHOD

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 25, No 5, May 80 pp 1088-1090 manuscript received 18 Dec 78

YEVEL'SON, R. L.

[Abstract] The solution of the Helmholtz equation for a medium with a dielectric constant, slowly changing as a function of two coordinates and arbitrarily from a third, is reduced to the solution of a recurrence system of ordinary differential equations of the second order. The present short communication discusses a method for construction of a formal solution of this equation in the case when $\varepsilon(\vec{r})$ is a slowly changing function of x and y with a scale L and the quickly or arbitrarily changing function z. This method expands the possibilities of the method of geometrical optics and makes it possible to work out more unsolved problems. In addition, the method is free from the difficulties characteristic of the method of geometrical optics in absorbant media. References: 6 Russian.
[284-6415]

OSCILLATORS, MODULATORS, GENERATORS

UDC 621.373

MUTUAL SYNCHRONIZATION OF NONISOCHRONOUS OSCILLATORS

Kiev IZV. VUZ: RADIOELEKTRONIKA in Russian Vol 23, No 5, May 80 pp 26-30
manuscript received 24 Jan 79; after revision 30 Jul 79

DEM'YANCHENKO, A. G., VLSIN, S. V. and SMIRNOV, V. B.

[Abstract] In a previous paper by A. G. Dem'yanchenko, the mutual synchronization of isochronous oscillators is extensively investigated. It is shown that at high frequencies, particularly in the microwave range, the feedback in oscillators proves to be a complex but nonlinear element--inertial, i.e., the oscillators turn out to be nonisochronous. The present paper investigates the effect of nonisochronism of oscillators on the parameters of their mutual synchronization. These investigations show that the nonisochronism of the oscillators with mutual synchronization leads to an expansion of the band of mutual synchronization which is caused by an increase of the unilateral synchronization of nonisochronous oscillators. In general, the resonance characteristics are asymmetric and are shifted with respect to the zero separation between the natural frequencies of the oscillators. With an opposite phase of the mutual synchronization of equivalent nonisochronous oscillators, two stable regimes and a jump-over between them are possible, during which one of the regimes ordinarily exists in a wider range of parameters than the other. Figures 3; references: 1 Russian.
[277-8415]

UDC 621.373.018.3

INSTABILITY OF STATIONARY REGIME OF BIHARMONIC SELF-OSCILLATOR CONDITIONED AT PHASE RESPONSE OF LOAD IMPEDANCE ON THE HARMONIC FREQUENCY

Kiev IZV. VUZ: RADIOELEKTRONIKA in Russian Vol 23, No 5, May 80 pp 76-78 manuscript received 19 Feb 79; after revision 23 Jul 79

KARACHEV, A. A. and TSARAPKIN, D. P.

[Abstract] In this short communication an analysis is made which shows that a standard simplified investigation of a self-oscillator, during which the properties of an oscillating system solely in the vicinity of the frequency of the fundamental oscillation are taken into account, can lead to incorrect results. Taking account of the load impedance at the harmonic makes it possible to identify a new type of instability of a self-oscillator, which it appears can be extended to more complex self-oscillating systems including microwave oscillators. If with respect to design considerations it is impossible completely to eliminate resonance in the area of the harmonics of the fundamental oscillation, it is necessary to assure an abrupt reduction of their Q-factor in order to gaurantee the stability of a stationary regime. Figures 3; references 4: 2 Russian, 2 Western (one in translation).
[277-6415]

UDC 621.373.12

ON THE ENERGETIC SYSTEMS OF TWO RESISTIVE COUPLED SELF-OSCILLATORS

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 25, No 5, May 80 pp 997-1005 manuscript received 9 Mar 78

[illegible]RASH, V. V. and UTKIN, G. M.

[Abstract] Using the method of slowly changing amplitude, the paper investigates the energy regime of a system of two resistive coupled self-oscillators and its optimization and stability. Also investigated is the question of the stability of the frequency of oscillations. Recommendations are given with respect to the design of a coupling scheme between self-oscillators. The following points are considered: 1) Equations of a system of resistive coupled self-oscillators; 2) Energetics of steady-state regimes; 3) Malfunctions of the operation of a system of two resistive coupled self-oscillators; and 4) Frequency of oscillations and its stability

in a system of two resistive coupled self-oscillators. An experimentally investigated system of two resistive coupled self-oscillators using Type KT-911 transistors based on a circuit with a grounded collector and a nonsymmetrical band resonator between the base and collector is described. Figures 8; references 6: 4 Russian, 2 Western.
[285-6415]

UDC 621.373:519.68

ANALYSIS WITH THE USE OF COMPUTERS OF FLUCTUATIONS IN COMPLICATED SELF-OSCILLATING SYSTEMS

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 25, No 5, May 80 pp 990-998 manuscript received 22 Jan 79

SAVVEEV, V. V., SHEPELAVICH, L. G. and YAKIMOV, A. V.

[Abstract] An algorithm is presented for determination of the spectral characteristics of amplitude-phase fluctuations at various points of a self-oscillating system with many degrees of freedom. The proposed algorithm is based on the use of a system of fluctuating equations, obtained from the corresponding asymptotic equations for amplitude and phase. A self-oscillating system with N/2 degrees of freedom is considered. Fluctuations of the amplitude and phase oscillations of currents and voltages in the neighborhood of a stable steady-state regime are described by a system of N linear differential equations. A relation is derived which makes it possible to perform a calculation of the spectra of the fluctuations of oscillations at any point of the system using the operations of the algebra of complex matrices. The algorithm described is realized with sufficient simplicity in the form of calculations on the "BESM-6" computer, written in the FORTRAN language. During this a wide possibility is presented for the use of programs for the algebra of complex matrices from the library of standard programs which enter the software of the computer in question. As examples of the use of the algorithm, the results are presented of calculations of the fluctuation characteristics of two self-oscillating systems--a quartz and a ring oscillator. Figures 3; references 9: 8 Russian, 1 Western.
[284-6415]

PHOTOELECTRIC PHENOMENA AND DEVICES, ELECTROLUMINESCENCE, ION DEVICES

UDC 621.3.032.217:681.785.5:620.1

INVESTIGATING THE COMPOSITION OF THE GaInAs SURFACE OF PHOTOCATHODES BY AUGER SPECTROSCOPY

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 24, No 6, Jun 80 pp 1249-1255 manuscript received 5 Jun 79

GAVANIN, V. A., MUSATOV, A. L. and TURCHINSKIY, V. M.

[Abstract] A quantitative analysis is made of the composition of the $Ga_{0.82}In_{0.18}As$ surface of epitaxial layers after cleaning by ultravacuum heating. An investigation is made of the change in composition of the GaInAs surface of photocathodes during the process of manufacture by two-stage activation, and the distribution of indium in the near-surface layer of such photocathodes is determined. The surface properties of the photocathodes were studied by Auger electron spectroscopy. Electronic current was in a range of 3-10 μA, and electron energy was 3 keV. Indium distribution in the near-surface region was determined by ionic etching with an argon gun with simultaneous monitoring of the Auger peak of indium. It was found that surface cleaning by heating to about 600°C in a vacuum of about 10^{-10} mm Hg reduces the surface concentration of indium by a factor of more than 4, the depth of the depletion region being about 60 Å. During the process of two-stage activation of the photocathode there is a considerable increase in the indium concentration throughout the depletion region, which is one reason for the increased quantum yield of photoemission. The authors thank A. V. Lebedev for assistance with some of the experiments, and also N. S. Strel'chenko, A. A. Matvash and V. I. Mavor for providing the epitaxial layers of GaInAs. Figures 3; references 11: 2 Russian, 9 Western (1 in translation).
[292-6610]

POWER SYSTEMS (INCLUDING EFFECT OF VARIOUS ITEMS ON POWER TRANSMISSION)

UDC 621.3.053.1.193/.199

SUBDIVISION OF A TERRITORY ACCORDING TO THE SUBSURFACE CORROSION OF GROUNDING DEVICES

Moscow ELEKTRICHESKIYE STANTSII in Russian No 4, Apr 80 pp 51-56

DEMIN, Yu. V., candidate of technical sciences, TSELEBROVSKIY, Yu. V., candidate of technical sciences, AYZIKOVICH, S. I., engineer, BEZVERKHOVA, S. A., engineer, GINZBURG, G. B., engineer, and SORKIN, R. A., engineer, Siberian Scientific-Research Power Institute; Turkmen Main Power Supply Administration

[Abstract] Corrosion of grounding devices is maximum in saline soil, moderate in seaside soil, and negligible in foothill soil and in sand. Since there are no sources of stray direct currents within the territory of the Turkmen SSR, breakdown of grounding devices here is solely due to subsurface corrosion. This mode of corrosion is electrochemical in nature and depends largely on the soil characteristics. A method of forecasting the service life of steel grounding equipment has been developed, and tested throughout Asian and European regions of the USSR, which is based on an arbitrary $K_1 \ldots K_5$ corrosion scale and an empirical formula in which the electrical resistivity of the soil, the moisture content, the saturation level, and the $Cl^- + SO_4^{2-}$ concentration and the Cl^-/SO_4^{2-} ratio are taken into account. The method deviates from the GOST 9.015-74 procedure. On the basis of extensive measurements and calculations, a corrosion map of the Turkmen SSR territory has been plotted. Figures 3; tables 1; references: 2 Russian.
[300-/6131]

UDC 621.311.4.027.81/.89

A SINGLE-TRANSFORMER 500 kV AND HIGHER-VOLTAGE SUBSTATION

Moscow ELEKTRICHESKIYE STANTSII in Russian No 4, Apr 80 pp 72-73

[illegible], E. M., engineer, USPENSKIY, B. S., engineer, and YAKUB, Yu. A., engineer

[Abstract] This is a critical comment on the article by Yu. P. GRYUNTAL', A. K. MIKHAYLOV and G. A. SLAVIN on the subject in ELEKTRICHESKIYE STANTSII, No 6, 1978. It is pointed out that the proposed scheme of automatically connecting the auto transformer standby phase does not appear to be adequate and practical from the standpoint of circuit breakers and disconnect switches. A more precise cost and reliability analysis underscores, furthermore, that a single-transformer 500 kV and higher-voltage (750 and 1150 kV) substation with such a scheme is not feasible. Figures 1; tables 2; references: 2 Russian.
[900-2615]

UDC 621.315.05.001.5

ANALYSIS OF COMPOUND ELECTRIC POWER TRANSMISSION

Moscow ELEKTRICHESTVO in Russian No 6, Jun 80 pp 8-12 manuscript received 5 Nov 79

[illegible], I. S., Energoset'proyekt [All-Union State Planning, Surveying and Scientific Research Institute of Power Systems and Electric Power Networks]

[Abstract] Addition of the output voltages from two single-phase full-wave rectifiers is considered, the alternating input voltages to each having the same amplitude and frequency. The resultant output voltage is calculated, taking into account a phase shift between them and the resulting waveform, i.e., harmonic content. Compound asymmetric transmission of both a.c. and d.c. electric power over the same 3-conductor transmission line is analyzed on this basis, with no need for special transformers or other devices. Power calculations indicate an approximately 17% higher loss here than in a simple a.c. transmission line of the same class. The power loss can be lowered to the same level by either reducing the voltage on the compound transmission line by 6% or decreasing the line-to-line resistance by 17%. The power loss per unit transmitted power is, however, approximately 60% lower than in a.c. or d.c. lines. Figures 4; references: 5 Russian.
[[illegible]]

UDC 621.315.1.015.38.001.24

CALCULATION OF THE DISTORTED WAVEFORM OF ATMOSPHERIC OVERVOLTAGES ALONG TRANSMISSION LINES

Moscow ELEKTRICHESTVO in Russian No 6, Jun 80 pp 58-61 manuscript received 30 Mar 79

GUMEROVA, N. I., candidate of technical sciences, YEFIMOV, B. V., candidate of technical sciences, and KOSTENKO, M. V., corresponding member of the USSR Academy of Sciences, Leningrad Polytechnic Institute

[Abstract] The propagation of atmospheric overvoltage waves along electric transmission lines, with the attendant waveform distortion caused simultaneously by the surface effect in the earth and in the conductors and by the nonlinear corona characteristics, is analyzed by the method of traveling waves and on the basis of the equivalent single-conductor line. The effect of the earth on the conductor is accounted for according to the Carson relation and the effect of a nonlinear corona is simulated by lumped-parameter circuit elements between nondistorting segments of the conductor. Currents and voltages at successive instants of time are calculated accordingly, and the equivalent impedance of the line is calculated for the case of a frequency-dependent conductor resistance in a series chain of twopole networks. The results of numerical computation agree closely with experimental data. Figures 3; references 4: 3 Russian, 1 Western.
[298-2415]

UDC 621.315.624.8-761.001.5

OPTIMUM THICKNESS OF HYDROPHOBIC COATINGS FOR HIGH-VOLTAGE INSULATION

Moscow ELEKTRICHESKIYE STANTSII in Russian No 6, Jun 80 pp 62-64

MAYTRUTA, L. I., candidate of technical sciences, MERKHALEV, S. D., candidate of technical sciences, and PICHUGIN, V. M., engineer, Scientific Research Institute of Direct Current; Pribaltiyskaya State Regional Electric Power Plant

[Abstract] Hydrophobic coatings are applied for the purpose of improving the reliability of high-voltage insulators, especially in contaminated industrial atmospheres. A study of hydrophobic pastes KV-3 and ORGRES-130 (the latter pure or diluted 1:1 with white spirit), also a Polish-made paste, was made to determine the optimum coating thickness. Insulators

were coated with 0.2-1.0 mm thick layers, whereupon the depth of contaminant penetration and the discharge voltage were measured periodically for three years. The contaminant absorption was found to increase with increasing layer thickness and reaching the saturation level of 20 mg/cm^2 at the 0.8 mm thickness. The discharge voltage was found to decrease with time, faster with thinner coatings but not much slower with coatings thicker than 0.5-0.7 mm. This must be regarded as the optimum range of coating thicknesses, the insulator surface condition prior to coating having no effect on the discharge voltage as long as the coating thickness is larger than the contaminant penetration depth. Figures 5; tables 1.
[159-2415]

PRODUCTION TECHNOLOGY

UDC 658.52.011.56:621.886.1

AUTOMATIC DEVICE TO HATCH PINS

Moscow PRIBORY I SISTEMY UPRAVLENIYA in Russian No 5, 1980 p 31

MOROZOV, A. I., engineer

[Abstract] The Central Planning and Design Bureau for Mechanization and Automation (Riga) made ready and placed into production an automatic device to hatch pins of various shapes with a diameter of 2-3 and a length of 4-12 mm. The output of the device is 100 pins per minute. It consists of a vibration-feeding unit, a mechanism for piece by piece supply of blanks, a cutting mechanism and an electromechanical drive. Figures 4. [78-6415]

UDC 519.21

PULSE DURATION PROBABILITY DENSITY AT THE OUTPUT OF A DELAY MULTIVIBRATOR DURING ITS START-UP BY PULSES OF A CHAOTIC PULSE SEQUENCE

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 25, No 5, May 80 pp 1105-1108 manuscript received 27 Oct 78

YEROFEYEV, Yu. N.

[Abstract] During start-up of delay relaxators by pulses of a chaotic pulse sequence with a random magnitude of the intervals between pulses, the duration of the output pulses also proves to be a random magnitude. It is possible to consider the assumption concerning the constancy of duration of output pulses, accepted during an analysis in the literature of the start-up of a delay relaxator (electron relay) by a fluctuation voltage, as only a first approximation, correct only in those cases where the time intervals between alternate operations of a delay relaxator are left random, essentially exceeding nevertheless the duration of the output pulses. In the general case, because of the finite time between the energy recovery at the accumulator element of a delay relaxator and the moment of the arrival of the alternate starting pulse, the value of the energy will differ from the initial value. Consequently, the duration of the output pulses depends both on the distribution law for the probability density of the intervals between starting pulses and on the parameters of delay relaxators. On the basis of a 1968 work by the author of the present short communication, the situations discussed above are considered, using as an example the typical circuit of a transistorized delay multivibrator. The results of processing the data obtained in a particular case are presented. Figures 4; references: 4 Russian.
[284-6415]

UDC 621.373

OPTIMIZING THE CIRCUIT OF A NANOSECOND PULSE GENERATOR WITH A SHAPING LINE AND A DISTRIBUTED MAGNETIC COMMUTATOR

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 24, No 6, Jun 80 pp 1310-1312 manuscript received 20 Nov 78

MESHKOV, A. N.

[Abstract] The author considers the process of charging of a shaping line through the inductance of a saturated choke connected in series with the capacitor in the last link of a magnetic generator. A section of transmission line with a saturable magnetic component (ferrite or Permalloy) is used as the commutator for connecting the charged line to the load. This method reduces the rise and fall times of the square pulse across the load. The pulse duration is equal to twice the delay time of the lines in the state where the magnetic component of the transmission line is saturated. Pulses can be shaped with powers of tens of megawatts. A technique is proposed for optimum choice of the line parameters in such a circuit to maximize efficiency while maintaining the proper output pulse shape. Experiments show that a generator with pulse power of 1 MW can shape pulses with duration of 80 ns, rise time of 7 ns, fall time of 12 ns and recurrence rate of 20 kHz with 93% efficiency of the output shaper. Theory agrees satisfactorily with experiment. Figures 1; tables; references: 6 Russian. [292-6610]

UDC 621.373.144.072.9

SYNCHRONIZATION OF PULSE SYSTEMS WITH DELAYED FEEDBACK OF THE RECIRCULATION TYPE

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 25, No 5, May 80 pp 1006-1013 manuscript received 19 Jun 78

KONDRATYUK, V. V. and MALEVICH, I. A.

[Abstract] A number of time analysis systems have recently been proposed which use the principles of phase synchronization pulse systems with delayed feedback (PSDF) and play the role of basic time-assigning elements. In these systems the characteristics of time resolution are obtained over a wide dynamic range and a stability of the time base is close to the theoretical prediction. In the present paper, the properties of stationary

and transient regimes of PSDF under conditions of phase synchronization are investigated on the basis of the method of point transformations. The need for a study of the transient regime of a PSDF being synchronized is established by the fact the start of forming of the time base of the above and other time-measuring systems is tied to a signal randomly arranged with respect to the base of the synchronizing oscillations, which (as shown in the present work) leads to a noticeable effect on the transient processes in the precision of forming the time-assigning sequence. Figures 3; references 6: 5 Russian, 1 Western.
[284-6415]

UDC 621.373.144.072.9

INFLUENCE OF NOISE ON SYNCHRONIZATION OF A PULSE SYSTEM WITH DELAYED FEEDBACK OF THE RECIRCULATION TYPE

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 25, No 5, May 80 pp 1014-1021 manuscript received 11 Jul 78

KONDRATYUK, V. V. and MALEVICH, I. A.

[Abstract] The results are discussed of an analysis of the properties of recirculation-type oscillators in a regime of synchronization by an exterior harmonic signal with the presence in the system of noise, under conditions where the distribution of the natural period of a pulse system with delayed feedback (PSDF) is different from the delta function. The boundedness and independence of the fluctuations of the period at each cycle of circulation are assumed. Experimental investigations of the distribution density of the period of an autonomous PSDF indicates in reality localization of fluctuations in some small area around the average value of the period. With regard to conditions of independence, the latter is the simplest for analysis and at the same time maintains the characteristic properties of the process of establishment and steady-state distribution of the phase of a PSDF in a synchronization regime. The requirement for independence of the fluctuations does not touch upon the conditions of locking of phase of PSDF. Numerical calculations are made. Figures 5; references: 3 Russian.
[284-6415]

QUANTUM ELECTRONICS

UDC 621.317.444.029.7

SINGLE-COMPONENT QUANTUM MAGNETOMETER WITH FEEDBACK BASED ON THE HANLE SIGNAL

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 25, No 5, May 80 pp 1038-1041 manuscript received 28 Dec 78

KOTKIN, A. L., MAYORSHIN, V. V. and UMARKHODZHAYEV, R. M.

[Abstract] The Hanle effect on atoms in a base state is widely used for measurement of the components of ultraweak magnetic fields. In a 1977 work by the authors of the present paper, a comparison is made of the characteristics of single-component quantum magnetometers with feedback based on a Hanle signal, for fast and slow (in comparison with the width of the line) modulation. The case is considered where the magnetic field being measured is parallel to the modulation field and perpendicular to the ray of the pumping light. As is known, the presence of transverse components of the magnetic field being measured leads to a deformation of the form of the Hanle signal. The present work examines the effect of the transverse components of the magnetic field being measured on the characteristics of a single-component magnetometer with feedback and the use of fast modulation. It is shown that a magnetometer with feedback based on the Hanle effect can be used with high precision for stabilization of a zero-order magnetic field. Figures 1; references 6: 5 Russian, 1 Western.
[284-6415]

UDC 621.373.826

USING SYNCHRONIZATION TO DETERMINE LASER PARAMETERS

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 24, No 6, Jun 80 pp 1222-1226 manuscript received 5 Dec 78

VOROBEYCHIKOV, E. S., GUSEV, V. G., POYZNER, B. N. and POPOV, L. N.

[Abstract] A great deal of research has been done on laser sychronization from the viewpoint of laser behavior in this working mode. In this paper the authors consider the investigation of laser synchronization as a source of information on the properties of the active medium. An approach is suggested that is based on a system of differential equations for the amplitude and phase of the field of radiation of a laser synchronized by a light signal. The proposed technique can be used to measure parameters of nonlinear and frequency-dependent polarization of the active medium of a gas laser based on computer analysis of a family of curves for synchronization of a single-frequency laser plotted from experimental measurements. A system of algebraic equations is derived that describes this family of curves with power-law polynomial approximation of the nonlinear and frequency properties of polarization. The method can be realized by conventional systems for injecting an optical signal. Estimates are made of the required technical parameters of the measurement instrumentation. References 17: 13 Russian, 4 Western.
[292-6610]

RADARS, RADIONAVIGATION AIDS, DIRECTION FINDING, GYROS

UDC 621.391

OPTIMUM ESTIMATION OF THE ANGLE COORDINATES OF AN AIRCRAFT IN MULTICHANNEL RADIO DIRECTION FINDING

Moscow RADIOTEKHNIKA in Russian Vol 35, No 6, Jun 80 pp 28-32 manuscript received 15 Jan 80

BOGACHEV, A. S.

[Abstract] The method of Markovian optimum nonlinear continuous filtration as developed by R. L. Stratonovich is applied to theoretical synthesis of a device for processing continuous signals to determine the time-variable angle coordinates of an aircraft. A quasi-optimum two-coordinate radio direction finder is synthesized in the Gaussian approximation in which the reception system is an array of arbitrary configuration, assuming an additive mixture of useful signal and steady-state Gaussian white noise. The author thanks M. S. Yarlykov for constructive criticism. Figures 2; references 8: 7 Russian, 1 Western (in translation).
[296-6610]

UDC 621.391.2

PECULIARITIES OF SPACE-TIME PROCESSING IN A MOVING RADAR WITH LONG-TIME COHERENT SIGNAL STORAGE

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 25, No 5, May 80 pp 1102-1105 manuscript received 12 Oct 78

GOLKIN, D. V.

[Abstract] Systems of space-time processing have mainly been analyzed under conditions where the time of coherent signal storage is limited by the amount by which the coordinates of the objects observed do not change substantially. However, because these conditions can be broken in the case of movement of the radar relative to the signal sources, the present short communication considers the peculiarities of space-time processing

in a moving radar with long-time signal storage. In the study it is presupposed that reception is accomplished by an antenna with a linear aperture at which the plane waves of the useful signal and the interference react. It is also considered that the complex amplitude of the oscillations of the noise field at the point of the aperture describes the superimposing of a great number of complex amplitudes of the coherent interference signals. Such interference can be produced by a combination of motionless point reflections uniformly distributed in a space with a large density. Based on these assumptions, a decision function is derived which describes the optimum space-time processing. In the general case, this decision function is realized with the aid of a multichannel circuit which provides complete suppression of interference from all sources with the number of receiving channels $n \geq m + 1$. With $n < m - 1$ it is possible completely to suppress the interference oscillations from all sources, merely reducing to zero all the directivity pattern. For an analysis of the peculiarities of detection in a moving radar with long-time coherent signal storage a double integral is used which is a non-standardized coefficient of correlation of the complex amplitudes of useful and interference signals. In practice, significant cases of interference conditions of space-time processing in a moving radar with long-time coherent signal storage can be reduced to a two-channel circuit. Figures 2; references: 3 Russian.
[284-6415]

UDC 621.391.26:621.396.96

EVALUATING THE ACCURACY OF A SINGLE-CHANNEL GONIOMETER WITH COMPARISON OF AMPLITUDES IN THE CASE OF RANDOM SIGNAL LOSS

Moscow RADIOTEKHNIKA in Russian Vol 35, No 6, Jun 80 pp 45-47 manuscript received after completion 23 Jun 79

VISHNYAKOV, V. A.

[Abstract] An analysis is made of the accuracy of single-channel amplitude direction finding when a goniometer is subjected to the simultaneous action of jitter and losses of the useful signal. It is shown that systematic error is absent only in equisignal directions. As the ratio of the signal amplitude to the standard deviation increases, there is a reduction in systematic error, and the variance of the estimate of the direction of reception approaches a constant value that is nearly independent of the variance of the jitter, being determined by the probability of loss of signal, and the sample sizes at two positions of the polar pattern of the receiver

output. The systematic error can be reduced by increasing the signal-to-noise ratio of the received signal. The variance of the estimate can be reduced only by increasing sample sizes. Practical limitations are imposed by transmitter power and the dynamics of target motion. Figures 2; references: 2 Russian.
[296-6610]

RECORDERS

MAGNETIC RECORDING EQUIPMENT FOR 1980

Moscow RADIO in Russian No 4, 1980 pp 33-37

BOROVKOV, N., KROKHIN, N. and KURDYUMOVA, L., Moscow

[Abstract] The article summarizes information on reel-to-reel and cassette tape decks and recorders, as well as combinations of tape recorders with turntables and radios that will be available in the Soviet Union in 1980. Tables are given with data on tape speed, maximum recording and playback time, wow and flutter, type of reel or cassette accommodated, working frequency band, nominal output power, power consumption, size, weight and price. Models include 22 reel-to-reel recorders, 19 cassette recorders, 7 tape decks, 6 radio-turntable-tape combinations, 8 portable radio-tape recorder combinations and 3 car radio-tape recorder combinations. More detail is given on certain specific models. Tables 2.
[291-6610]

NEW TAPE-TRANSPORT MECHANISMS FOR CASSETTE RECORDERS

Moscow RADIO in Russian No 4, 1980 pp 41-42, 65

KIRICHENKO, V., DROZD, A. and SHIYAN, V., Kiev

[Abstract] The article describes high-quality quiet three-motor drives based on piezoelectric motors for cassette recorders. The working principle of these devices involves conversion of electrical energy to ultrasonic waves by a piezoelectric resonator, and conversion of the ultrasonic wave energy to mechanical energy of rotation or displacement. These motors have a number of advantages: 1) Excellent start-stop characteristics; 2) High specific power characteristics of the drive units; 3) Reduced power consumption due to drive efficiency as high as 90%; 4) Elimination of components for shielding the recording channel from magnetic fields; 5) Use of inexpensive and readily available ceramics in place of copper and magnetic alloys; as well as 6) Reduction in the weight and size of tape recorders while improving reliability. Figures 3; references 9: 7 Russian, 2 Western.
[291-6610]

SEMICONDUCTORS AND DIELECTRICS, CRYSTALS IN GENERAL

UDC 621.37/39:534

ELECTRON-FLUX AMPLIFICATION OF SURFACE ACOUSTIC WAVES

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 24, No 6, Jun 80 pp 1276-1282 manuscript received 21 Nov 78

LAZERSON, A. G. and SUCHKOV, S. G.

[Abstract] The authors consider interaction of a surface acoustic wave with a stream of electrons formed in crossed electric and magnetic fields. Two types of interaction are observed depending on whether the vector of magnetic induction is perpendicular (M-type) or parallel (M-J-type) to the vector of the normal to the surface of the piezoelectric crystal. In either case, the synchronism required for interaction is achieved by curved motion of the flux electrons in the crossed fields. The results of numerical calculations are given for the frequency dependence of gain at different current densities in M-J interaction for lithium niobate. Angular dependences of gain are given for M-type interaction under conditions of geometric resonance. The results show the feasibility of realizing considerable gains at low current densities. The maximum gain increases with frequency, and therefore it is suggested that these techniques be used for amplification in the microwave band. Figures 4; references 3: 2 Russian, 1 Western. [292-6610]

UDC 621.382

MEASUREMENT OF THE LIFETIME OF CHARGE MINORITY CARRIERS IN THE BASE REGIONS OF DIODE AND THYRISTOR STRUCTURES AT HIGH CURRENT DENSITIES

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 25, No 5, May 80 pp 1063-1071 manuscript received 22 Feb 78

GRIGOR'YEV, B. I. and TOGATOV, V. V.

[Abstract] On the basis of a solution of continuity equations for the base regions of p^+-n-n^+ and p^+-n-p^+-n^+, the errors are analyzed of the measurement of lifetime in devices with arbitrary thicknesses of the base, which are caused by a change of the injection coefficients of p-n junctions. It is shown that the error of measurement of lifetime by the standard B. Lax method can reach more than 100 percent. A method is proposed and substantiated, with which the measured values of the lifetime practically do not depend on the injection coefficients of p-n junctions and the thickness of the base regions. The results of a theoretical analysis and the reliability of the proposed method of measurement of the lifetime are experimentally confirmed in a unit especially developed for these purposes. Figures 4; references 5: 4 Russian, 1 Western.
[284-6415]

UDC 621.382.3

MEASUREMENT OF THE MINORITY CHARGE CARRIER LIFETIME IN THE HIGH-RESISTANCE COLLECTOR REGION OF POWER TRANSISTORS

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 25, No 5, May 80 pp 1115-1116 manuscript received 10 Nov 78

GRIGOR'YEV, B. I. and TOGATOV, V. V.

[Abstract] High-voltage power transistors intended for operation in switching circuits are characterized by the large width of the collector region and the low concentration of donor impurities in it. During operation of such transistorized switches in a saturation mode with large current densities, the magnitudes of the static current amplification factor and the voltage drop at the structure are determined to a considerable degree by processes in the high-resistance collector region. The latter in turn are characterized by the value of the lifetime of holes in the collector. The present short communication is concerned with development of a nondestructive method of measuring the lifetime of holes in the collector region of

a transistor. Fifty power silicon transistors of different types are investigated. A paper, "Measurement of the Minority Carrier Lifetime in the Base Regions of Diode and Thyristor Structures at High-Current Density," by the authors of this short communication appears in the same issue of RADIOTEKHNIKA I ELEKTRONIKA. This paper and the short communication are closely related. Figures 2; references: 1 Russian.
[284-6415]

UDC 621.382-71:536.24.001.24

THERMAL DESIGN OF COOLING FOR SEMICONDUCTOR DEVICES

Moscow ELEKTROTEKHNIKA in Russian No 6, Jun 80 pp 46-48 manuscript received 26 Mar 79

ROYZEN, L. I., candidate of technical sciences, DUL'KIN, I. N., candidate of technical sciences, and MAKEDONSKAYA, L. N., engineer

[Abstract] Design calculations are shown for heat sinks with water cooling used with power semiconductor devices. First the two-dimensional temperature field is determined on the basis of the Laplace equation for an axisymmetric cylindrical system with a boundary condition of the second kind at the contact surface, a boundary condition of the third kind at the free surface, and thermal insulation at all other surfaces. The problem is then reduced to a one-dimensional one. The solution serves as a basis for calculating the design parameters for various configurations such as unilateral or bilateral finning of the heat sink. The general procedure involves calculating the velocity of the water stream, the Reynolds number, the equivalent heat transfer coefficient (Nusselt number), the fin efficiency, the Biot number, and the thermal resistance. This procedure is demonstrated here on two practical examples: a cylindrical heat sink with a spiral groove as the water channel mounted under a T-800, and three T-630 thyristors mounted symmetrically around a tubular heat sink for cooling with deionized water. Figures 4; references: 7 Russian.
[294-2415]

UDC 621.382.233.011.222.072.1

CALCULATION OF SWITCHING VOLTAGE AND MAXIMUM VOLTAGE IN HIGH-VOLTAGE pnpn STRUCTURES

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 24, No 6, Jun 80 pp 1264-1268 manuscript received 15 Dec 79

KUZ'MIN, V. A. and YURKOV, B. N.

[Abstract] An examination is made of pnpn-type switches, and calculations are done on the maximum voltage U_{max} (the "knee" of the current-voltage characteristic), the switching voltage U_{sw}, and the switching current I_{sw} with consideration of the effective shunting across the pn^+ junction, the influence of the pulling field, and modulation of the thickness of the n-base. The breakdown voltage of the central pn junction is calculated for a diffusion junction with Gaussian distribution of the acceptor impurity. It is shown that the influence of carrier multiplication in the p-layer may reduce the breakdown voltage by 30-40%. It is found that the pulling field in the n-base has little effect on U_{max}. It is shown that the influence of the electric field causes a considerable drop in I_{sw} and a slight drop (about 5%) in U_{sw}. This effect increases with thickness of the n-region. The difference in coefficients of the avalanche multiplication of holes and electrons cannot be disregarded in calculating U_{sw}. Figures 4; references 10: 7 Russian, 3 Western.
[292-6610]

UDC 621.382.323

A COMPOUND-CONNECTED TRANSISTOR WITH TEMPERATURE-STABLE CURRENT-TRANSFER RATIO

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 24, No 6, Jun 80 pp 1320-1322 manuscript received 22 Dec 78

MATSON, E. A., GALUZO, V. Ye. and RUSAK, I. M.

[Abstract] Double-emitter followers are currently being widely used in analog devices. When such a circuit is used in an input amplifier stage, it is very important to stabilize the resultant beta with respect to temperature. In this article, the authors propose a temperature-stable modification of the double-emitter follower in which the input bipolar transistor is replaced by a field-effect transistor with the gate biased in

the forward direction. The temperature dependence of beta is compared for a compound transistor with two KT31' bipolar transistors, and a modification in which one of these transistors is replaced by the KP104 FET. It is shown that forward biasing of the pn junction of the gate gives a negative temperature coefficient of change in beta of about -0.005 deg^{-1}. Figures 3; references 7: 6 Russian, 1 Western in translation.
[292-6610]

UDC 621.382.333

OPERATION OF THE COLLECTOR JUNCTIONS OF EPITAXIAL TRANSISTORS AT HIGH CURRENT DENSITIES WITH CONSIDERATION OF AVALANCHE MULTIPLICATION OF CARRIERS

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 24, No 6, Jun 80 pp 1316-1319 manuscript received 28 Nov 78

GAVRILOV, L. Ye. and GAVRILOVA, V. V.

[Abstract] Operation of the collector junction at high current densities is typical for avalanche transistors. In previous research, the authors have considered the effects that arise at high current densities with avalanche multiplication of carriers in stepwise and smooth junctions. This paper examines the analogous process in the collector junction of an epitaxial transistor. The analysis is based on the actual impurity distribution in the GT338 mesa-epitaxial diffusion-alloy avalanche transistor. It is found that the electric field distribution in the junction is close to piecewise-linear. The maximum electric field intensity in the junction decreases with rising current, an effect that is enhanced at lower multiplication factors. The left (base) boundary of the junction layer shifts toward the right with increasing current. Epitaxial transistors are free of the hazard of base "puncture" as current increases for avalanche multiplication factors above the critical point. This relaxes requirements for homogeneity of junctions, and also considerably increases the speed of epitaxial avalanche transistors. Figures 3; references: 4 Russian.
[292-6610]

VARIOUS MISCELLANEOUS ITEMS, INCLUDING THEORIES

UDC 510(022)

IDENTIFICATION OF A ONE-DIMENSIONAL OBJECT

Novocherkassk IZV. VUZ: ELEKTROMEKHANIKA in Russian No 5, May 80 pp 485-492 manuscript received 14 Feb 78; after completion 20 Sep 78

HOKOTOV, V. P., candidate of technical sciences, dotsent, Moscow Institute of Electrical Machine Building

[Abstract] A signal is applied to the input of a deterministic stationary one-dimensional object and the output signal is approximated with the solution to a linear nonhomogeneous differential equation with constant coefficients. Two theorems are proved on the basis of which the general solution can be used for identifying the object. This method, which does not involve roots of a characteristic equation nor transcendental functions and matrices, is applicable to an object in an unexcited or excited state at the instant the input signal appears. References: 2 Russian.
[303-2415]

UDC 519.21

RELATIONS BETWEEN THE STATIONARY DISTRIBUTIONS OF STATES OF A SYSTEM WITH CONSIDERATION OF PRIORITIES IN FAILURES

Moscow IZVESTIYA AKADEMII NAUK SSSR: TEKHNICHESKAYA KIBERNETIKA in Russian No 3, May/Jun 80 pp 51-56 manuscript received 9 Jun 79

SHAKHBAZOV, A. A., Baku

[Abstract] The author considers the problem of finding expressions for the queue length in statistical equilibrium at arbitrary times in terms of the arriving customer's and departing customer's distribution for a stochastic service system with a single BCD queue, batch arrivals of customers and batch service. The theory of Markov processes with discrete time and renewal theory are used to solve this problem for a broad class of queueing systems: GI/M/1, M/G/1 and GI/M/s. The author thanks B. V. Gnedenko for constructive criticism. References 7: 3 Russian, 4 Western.
[287-6610]

UDC 533.9:621.3.029.73

RADIAL DISTRIBUTION OF He-Ne PLASMA AMPLIFICATION ON A WAVELENGTH OF 0.63 μm IN A MICROWAVE DISCHARGE

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 24, No 6, Jun 80 pp 1309-1310 manuscript received 23 Oct 78

MOLCHANOV, M. I. and PETRASHKO, G. A.

[Abstract] This paper gives the results of a comparative measurement of the radial distribution of amplification when a plasma is excited by a DC discharge and by a transverse microwave discharge. A modulation technique was used for measuring low gain. An electronic modulator was used for the DC discharge, and a semiconductor oscillator on 340 MHz was used for the microwave discharge. In the latter case the oscillator load was a stripline containing the gas-discharge cell. The modulation frequency was the same in both cases. The distribution of gain in the transverse microwave discharge was measured at the maximum possible oscillator amplification. In the DC discharge, the measurements were made for the current where the amplification of the radiation coincided with the amplification in the microwave discharge. The gas cell could be shifted in the vertical plane (y coordinate) and in the horizontal plane (z coordinate). It was found that in the region where the photocurrent remains constant, gain distribution is described by a zero-order Bessel function $J_0(2.405z/R)$. Lines of equal gain are concentric circles formed by the cross section of the function $J_0(2.405 - (\sqrt{y^2 + z^2}/R^2))$. There is almost no change in the nature of gain distribution with a switch from DC to transverse microwave discharge. Figure 1; references: 3 Russian.
[292-6610]

UDC 537.52

HIGH-CURRENT COAXIAL AIR DISCHARGE STABILIZED BY A DIELECTRIC WALL

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 24, No 6, Jun 80 pp 1218-1221 manuscript received 17 Jul 78

ALEKSANDROV, A. F., SAVICHEV, A. T., SUROV, O. I., TIMOFEYEV, I. B. and EMIL', A. R.

[Abstract] The authors study the H-constricted discharge in which the radius of the plasma shell can be rigorously determined. The reverse pinch is initiated by the explosion of metal applied to a dielectric cylinder. This technique is technologically feasible, and has certain advantages in setting up a steady-state reverse pinch since the pressure of the inside boundary of the plasma is balanced by the dielectric wall. The experiments were done on the Foton facility at a capacitance of about 500 μF and voltage of 30 kV. The discharge chamber was formed by two massive brass electrodes with the dielectric cylinder clamped between them. Aluminum was sputtered on the inner face of the cylinder. It is shown that the characteristics of the H-constricted cylindrical discharge are analogous to those of the discharge produced by exploding a number of wires. However, the explosion of the thin metal film produces radiation that is more uniformly distributed over the surface. Evaluation of the energy balance in the discharge shows that radiation and ionization energy play a major part in the balance. At a concentration of $2 \cdot 10^{18}$ cm^{-3} the ionization energy is about 7 kJ, whereas about 25 kJ goes to the radiation. The radiation of the H-constricted discharge is close to equilibrium with temperature of the radiating surface of about 2 eV. Figures 6; references: 4 Russian.
[292-6610]

UDC 62-50

SYNTHESIS OF SYSTEMS WITH DISCRETE-CONTINUOUS TIME

Moscow IZVESTIYA AKADEMII NAUK SSSR: TEKHNICHESKAYA KIBERNETIKA in Russian
No 3, May/Jun 80 pp 165-176 manuscript received 15 Dec 78

PEROV, V. P., Leningrad

[Abstract] An examination is made of the problem of synthesizing operators in systems with discrete-continuous time, i.e., those for which the input function is given by its values on finite time segments with equidistant spacing. The analysis is based on an approach that has been developed for continuous and discrete systems in which the input process is represented in a generalized orthogonal basis. It is shown that formulation of the problem of synthesizing a statistically optimum operator with discrete-continuous time is completely analogous to the corresponding formulation in the case of continuous or discrete time. The problem of synthesizing systems with discrete-continuous time is solved by realization of the synthesized operators. A general solution is found for the optimum operator, and block diagrams are given of the resultant systems. The solution for the weighting function of the optimum operator takes the form of a product of basis, filtration and signal conversion matrices. This structural division into factors represented by their own matrices is carried over into the systems that realize the optimum operator, thus simplifying practical realization. At the same time, the solution is generally applicable to a wide class of signals and interference. Figures 5; references: 8 Russian.
[287-6610]

UDC 62-50:531.3

THEORY OF MANIPULATION SYSTEMS (MECHANICAL PROPERTIES)

Moscow IZVESTIYA AKADEMII NAUK SSSR: TEKHNICHESKAYA KIBERNETIKA in Russian
No 3, May/Jun 80 pp 42-50 manuscript received 20 Jan 78

KOBRINSKIY, A. A., Moscow

[Abstract] The ideas of inherent properties of robots are presented with development of hypotheses and premises as a basis for global estimates of these properties, analytical expressions are given that quantify these estimates, and specific examples of calculation are presented. The proposed theory of manipulation systems is based on the concept of an

elementary operation, which is defined as an "instantaneous" motor task that is not referred to any definite time; an elementary operation assigns a certain condition imposed on the state of the manipulator grasping unit (for example its position, orientation, velocity and so on). These elementary operations are the elements that comprise a variety of motor tasks. Elementary operations of positioning, orientation, displacement and loading are defined and analyzed. It is shown how elementary operations are related to the properties of manipulation systems such as operability, practicality, mobility, flexibility, load-handling capacity, and accuracy. These properties are quantified as the statistical characteristics of the results of performance of the corresponding elementary operations. Figures 5; references 16: 13 Russian, 1 Polish, 2 Western.
[287-6610]

UDC 62-505:622.242

SYNTHESIS OF VARIABLE-STRUCTURE SYSTEMS FOR STABILIZATION OF MOVING OBJECTS

Novocherkassk IZV. VUZ: ELEKTROMEKHANIKA in Russian No 5, May 80 pp 522-526 manuscript received 2 Jun 78; after completion 21 Feb 79

DZHAFAROV, E. M. and ISKENDEROV, I. A.

[Abstract] Stabilization of anchored floating objects such as deep-sea oil drilling rigs is considered, first with a linear and then with a variable-structure regulator. A performance analysis based on the nonlinear equation of motion for such an object and by the phase-plane method reveals that a linear regulator is inadequate. A variable-structure regulator under the constraint of a maximum permissible excursion is synthesized, therefore, results obtained by analog and digital simulation indicating the adequacy of an automatic stabilization system built with such a regulator. Figures 5; references: 5 Russian.
[303-2415]

UDC 621.318.134.029.64

DELAY TIME OF MAGNETOSTATIC SURFACE WAVES IN FERRITE-DIELECTRIC-METAL STRUCTURES

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 24, No 6, Jun 80 pp 1286-1287 manuscript received 11 Oct 78

YESIKOV, O. S., TOLOKNOV, N. A. and FETISOV, Yu. K.

[Abstract] The delay time of magnetostatic surface waves is measured in three-layer ferrite-dielectric-metal structures. An external constant magnetic field was applied parallel to the plane of the structure and perpendicular to the direction of propagation of surface waves. Excitation and reception of the magnetostatic surface waves was done with two decoupled shorted waveguides separated by a distance of 4 mm. Probing pulses were produced by modulation of a traveling-wave tube working as an amplifier. The pulse shape was approximately Gaussian. Pulse delay time was recorded as a function of the external magnetic field at a fixed frequency. The results are interpreted in terms of dispersion characteristics for a magnetostatic surface wave in a ferrite-dielectric-metal structure. Figure 1; references 5: 2 Russian, 3 Western.
[292-6610]

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